

COMPUTER WORLD

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Second Generation Enthusiasts Cite Cost, Efficiency

By Phyllis Huginn

CW West Coast Bureau

LOS ANGELES Want a computer for 4% to 5% of the original cost? You can get it, and more and more companies are doing just that.

They aren't just small companies with penny-pinching problems, they are the blue chip corporations with vast computer requirements and the financial

resources to back them up.

This phenomenon is related to the fact that for some jobs, users are discovering that second generation can't be beat and you can buy this vintage of computer for anywhere from 4% to 50% of its original price.

One corporate manager said that he couldn't even justify the new 370/165 in a comparison with available cost performance of the second generation.

There is a reluctance, however, by some users to be identified as supporters of the second generation. The snobbery of "always first with the foremost and the newest" still exists, although Adrian Bos of Computer Sciences Corp. said at a recent conference that the stigma of second generation equipment is disappearing as FDP center costs are rising faster than all other corporate costs. By getting a

second-generation computer, he said, the manager can cut his overhead and save a programmer's job.

As Bos put it, "It used to be that you had to have the newest to keep your people since everyone wanted the latest thing. Now it's a question of job survival. This makes a difference."

Not only are users hesitant to be quoted on their use of second generation equipment, but some

brokers for the systems are equally reluctant. As one said, "I don't want publicity. Business is so good that I don't want more people getting into it."

The most extensive cost and performance analysis made by any user contacted was that of a large corporation whose computer complex consists of more than 30 third generation computers ranging from 20s and

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Mini Supplement Follows Page 12

One of the first stored-program computers, the huge Whirlwind I computer, was the forerunner of today's minicomputers.

In a special supplement, which follows Page 12, *Computerworld* takes an in-depth look at the minicomputer, its history, its current state, and its future.

Whirlwind I Equipment Racks



DEC PDP-8/E

Long Distance 'Theft' FBI Accuses Youth of 'Tapping' T/S Service, Copying Data Files

By Thomas J. Morton

CINCINNATI, Ohio

In a case pending trial here in U.S. District Court for the Southern District of Ohio, the Federal Bureau of Investigation is claiming that theft by long distance is not only possible, but that it actually took place.

FBI agents here have arrested Mark Steven Coffman, 18, of Cincinnati, who, according to affidavits for a search warrant filed here in the U.S. Commissioner's Office, "obtained a scheme or artifice to defraud or obtain property by fraudulent

pretense and without authority coupled with sending communication in interstate commerce by signals or sounds for the purpose of furthering a scheme or artifice in violation of Title 18, Section 1343, U.S. Code."

The government is claiming that Coffman unlawfully extracted information from a Louisville, Ky., time-sharing scheme. The government's charge is the interstate commerce of illegally obtained property.

The victim of the alleged theft is Metatrada Computing, Inc. of Louisville. According to FBI affidavits, Metatrada Computing, a time-sharing company using a GE 400 system, noticed unauthorized use of its T/S system on May 28 and 29 of this year by "a person or persons unknown."

Unauthorized Access

In the alleged unauthorized use of Metatrada's system by Coffman, the FBI affidavits state that Coffman used account numbers and passwords of Metatrada employees, a Metatrada customer, Structural Dynamics Research Corp., another customer, Prof. James L. Farmer, and the Kentucky Highway Department. Coffman, the FBI claims, extracted data from Prof. Farmer's files, from Structural Dynamics' files, and from Metatrada's own rate ledger accounts, general ledger, and billing records.

According to the FBI, Coffman was in the process of building a program that would have been based Metatrada's security system for all of his future accesses.

Metatrada's security system, according to the FBI, was composed of account numbers assigned to Metatrada customers and employees and passwords. To gain access to the Metatrada computer system, a customer would use an unlisted phone line and a Teletype on his own premises.

Once the circuit was connected, the customer would then punch in his account number, or user number, and the required password. Thus, once the system would be available.

Multiple Violations

On the 28th and 29th of May, the FBI affidavit stated, the unauthorized user employed a Metatrada employee's account number and password. "Once he gained access," the affidavit continues, "the unauthorized user executed programs under and extracted data from the Metatrada time-sharing system." Unauthorized use of the system also took place, according to the FBI, on June 1, 2, 8, 9, 10, 11, 12, 19, 20, and 23, 1970.

On June 11, the FBI affidavit stated, a computer operator at Metatrada called the security department of Cincinnati Bell Telephone Co. and advised them that someone had seized Metatrada's leased long line from Cincinnati to Louisville.

Traced and Identified

Cincinnati Bell traced the call and identified the originating telephone number as a business line terminating in a Touch-Tone instrument listed for Hypermarket, Inc. of Cincinnati. The FBI affidavit stated.

The Yellow Pages of the Cincinnati telephone book carry an

(Continued on Page 4)

Most System/3 Users Find Equipment Fulfills Expectations With Exceptions

By the CW Technical Staff

According to preliminary results of a continuing CW survey, IBM's System/3 seems to be living up to the expectations of most users, although several registered specific complaints about both hardware and software.

The majority of the early users are still impressed with the price, hardware reliability, and potential for expansion of the system. Software received a smaller share of the plaudits and a larger share of criticism.

Growing Acceptance

The most controversial element of the System/3, the 96-column card, seems to be growing in acceptance among those using it. Users speak enthusiastically of the easier handling and better use of storage space resulting from the smaller format.

One experienced user went so far as to predict the replacement of the 80-column card with the new card.

The few specific instances reported of machine failures were, however, encountered during the system's shake-down period and

all were said to have been quickly resolved.

Software

One System/3 user, who is also using a 360/50 and a 360/40, said he found RPG-III programs to be remarkably efficient in their core usage. He also noted that, although he expects to try Assembler when it becomes available, RPG-III already allows him to do "just anything" he expected of the System/3.

Compiler

Other users, however, complained of the awkwardness of handling the 3,000-odd RPG compiler, and of the 20-minute compile time required when using the relatively slow-speed I/O devices.

Although one user was disappointed by the lack of compile-and-go capabilities, no one complained about the diagnostic messages provided.

The users found some problems with the Look Ahead feature, automatic editing of numeric fields, and the compiler's inability to get around a punch check.

On the Look Ahead feature, a user noted that the input speed had to be in precisely the right sequence. If they weren't, he said, there would be no diagnostic warning and the deck might actually compile, but the program would go into a loop during attempted execution.

The Automatic Editing apparently cannot spot zero suppression on values less than a dollar.

One user said that IBM admitted the compiler was defective in terms of the punch check restart, but said that a correction would be ready shortly.

About a quarter of those surveyed had used IBM's Application Customer Service to get their systems efforts started, but half of these seemed unimpressed.

One user, who has corresponded with several others, said, "No one who has used it once is going to use it a second time."

User Lack Experience

Most users of the first System/3s seem to lack experience in the use of computers although a sizable number had

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NCR Battles for Local Government Contracts

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Copies Available of Bernhart-Fetter Software Patent

By a CW Staff Writer
WASHINGTON, D.C. - The U.S. Patent Office has issued, i.e., printed and made available, copies of the first true software patent.

Preliminary approval of the

Bernhart-Fetter invention, for computerized "control of plotting machines for making planar representations of three-dimensional objects," was reported in *Computerworld* April 8.

The program is already in use

in a television commercial for Norolco electric shavers.

Printing of the patent was really a technicality, although the approval could have been recalled at any time prior to actual issuance. Court challenges by potential infringers would be needed before any further controversy or change in Patent Office provisions could ensue.

The issuance culminates a nine year battle by Walter D. Bernhart and William A. Fetter, who were employees of Boeing Corp. when they first filed their application in November, 1961.

Patent Attorney Gordon A. Sanborn, of Seattle, took up the campaign against Patent Office rejections, and success first appeared possible last November when announcement was made that computer programs would no longer be automatically ex-

cluded from the realm of patentable inventions.

The patent is entitled "Planar Illustration Method and Apparatus, #3,519,997," and is assigned to Computer Graphics, Inc., of Wichita, Kansas. Issue date is July 7, 1970, and copies are available from the Patent Office here.

Applied Data Research Inc., of Princeton, N.J., is awaiting issuance of its patent on the Autoflow program, for which approval notice was received in June.

Computer Graphics received its "notice of allowance" in April, and a patent office official said that the three-month printing delay is "standard."

Computer Graphics President Don H. Aldritt said that the Patent Office had received "a number of requests" for copies of the patent.

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FBI Accuses Teenager of 'Tapping' T/S Service Files

(Continued from Page 1)

advertisement for Hypermedia, Inc. which says it is a Cincinnati-based time-sharing company employing a GE-430.

Besides the trace on June 11, the FBI affidavits stated that other traces on June 20 and 23, 1970, determined placement of the originating calls from phones in the offices of Hypermedia.

In one instance on June 23, the unauthorized user apparently struck the "Here Is" key on his Teletype, the FBI stated in its affidavits. On June 20, Richard L. Norris, a Metridata vice-president, had a Teletype printer attached to the system to record the unauthorized user's transactions.

When the "Here Is" key was punched, presumably inadvertently, on June 23, the recording printer typed out "Hermians", according to the FBI.

Ernest G. Bianco, president of Metridata Computing, according to the FBI, requested representatives of South Central Bell Telephone Co. in Louisville to conduct traces on the unauthorized use of his system, and authorized them to disclose the results of the traces to the FBI.

The first trace was completed June 11. On June 19, agents of the FBI, according to the affidavits, called upon the offices of Hypermedia in Cincinnati

requesting a Mark Hafield. The receptionist at Hypermedia, according to the FBI, said that there was no one employed at that concern by that name, "but that there was a Mark Coffman."

The agents, aware that someone was accessing Metridata's computer system at that exact time, tried to telephone the Cincinnati number. They accessing the Metridata system, the FBI affidavits stated.

While that line was busy, agents determined that Mark Coffman was in the office of Hypermedia, Inc., the source of the Cincinnati phone accessing Metridata's system.

Seen Leaving Building

Later, the affidavits continue, the agents observed a white male exiting from the rear door of the building containing the offices of Hypermedia, and exiting on a motorcycle from a parking station adjacent to the building. The license number of the motorcycle was checked, the FBI affidavits state, and it was determined that the vehicle was listed to Harold R. Coffman at the Cincinnati address.

Agents stated in their affidavits that they had observed the same white male they had seen leaving the building housing the offices of Hypermedia enter a resi-

dence at the Coffman address.

The agents also reported in their affidavits that the person had in his right rear pocket what appeared to them to be computer data printout sheets.

Search Warrant

A search warrant was issued to agents for Coffman and for the offices of Hypermedia. A warrant for Coffman's arrest was obtained, and he was sub-

sequently arrested.

In the government's complaint against him, it is stated that Coffman gave a signed statement that he did, in fact, commit the acts for which he is charged.

The FBI would not comment on the case, and no one at Hypermedia, Inc. of Cincinnati was available for comment.

Coffman was available, though free on \$500 bond. Ernest Bianco, president of Metridata Computing, when

asked for comment, said that he would rest due to the "sensitive nature" of the matter, not to give a statement.

Coffman, if found guilty, faces a possible five-year term, a maximum fine of \$1,000, or both on the Federal charges of transmission of stolen properties interstate by wire, radio or television. Depending on Kentucky law, he could face additional charges for the alleged theft of the properties.

DP Users in Trouble?

Ooops, There Goes a Million Kilowatt...

By Edward J. Bride

NEW YORK — Area computer centers will be among the last businesses to be blacked out, if and when that drastic step becomes necessary, the power company said last week.

Consolidated Edison is faced with the dubious task of depending on the weather, antiquated power generators, and purchased power from other geographic areas, now that a second power plant is out of commission for the summer.

Last week, the Ravenswood 3 plant, in the Borough of Queens, suffered a short circuit in at least four of 48 coils, shutting down the facility, which is capable of producing 13% of the area's electric power.

Ravenswood 3 is apparently lost for the summer, as is the Indian Point plant, which is provided 4.5% of Con Ed's power, [CW July 8].

A Con Ed official stated that, "because of the delicate equipment," businesses with computer would be among the last to be blacked out.

Residential areas would be the first, with high-rise apartment buildings and heavy industry rated near the bottom of the blackout list.

The spokesman insisted that the company is optimistic, but stated that the optimism is based on:

- No hot humid weather.
- No more units failing.
- Ability to purchase power.

Loss of the Ravenswood 3 plant reduces Con Ed's generating power to about 7.7 million kilowatts, including a half-million kilowatts purchased from area utilities.

Expected peak for the summer is 7,725,000 kilowatts, more than is currently available.

The power company has installed, and has already used, emergency diesel generators, but is reluctant to continue this procedure because of the considerable cost.

The company said that there has still been only one brownout this summer, and that was on Friday, June 12.

Peak power usage in the North-east is expected in late August.

Last year, there were eight "brownouts," and no blackouts, according to the Con Ed spokesman. Additionally, there were three requests to "heavy users" and two to the general public to reduce power usage.

The spokesman called on New York businesses to cut back on lights and air conditioning wherever possible, to avoid brownout, let alone blackout conditions.

The spokesman emphasized that measures have been implemented since the massive blackout in 1965, so that a repeat performance should be avoided.

Con Ed itself doesn't talk about reserves any more.

System/3 Users Find Equipment OK

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been late equipment users. The survey also revealed that a great variety of businesses were represented among the users, the applications were limited, for the most part, to the traditional payroll, general ledger, and inventory applications.

The relative lack of sophistication was perhaps shown by one user who enthused that his System/3 could do what the IBM 407 could, only faster.

This lack of experience was also shown by the method utilized by most users to evaluate the computers.

Most users said they had looked at other systems, such as

the Univac 200, NCR Century 100 and Honeywell 200 Series, but however, were unfamiliar with the concept of benchmark programs and relied on IBM's service reputation, published performance claims, and especially price to make their decisions.

The IBM System/3 seems to be finding its way to a group of users who up until now felt that they could not afford a computer.

A Midwest-town manager who said that the System/3 enables a small town to have the facilities of a computer system economically seemed to be speaking for many users.



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MEMOREX

Second Generation Enthusiasts Cite Cost, Efficiency

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1130s to 653s, and over 40 second generation computers of the 1401 and 7000 series class.

This company recently completed its five-year forecast plan and justifies use of the second generation equipment for five to 10 more years. This decision was arrived at for a number of reasons.

One is that the price-performance ratio between 7074s and 360/65s is one to 10 with throughput one to 1.7. The manager explained: "This means we would be paying 10 times as much for only seven tenths increased throughput. This ratio is based on equipment bought at 4% to 5% of original cost. The highest we have paid is 50% of the new price and that is a three to one saving."

No Qualms

The corporation has no qualms about its planned 5- to 10-year future use of the systems since it feels the central processor

is a solid, stable piece of equipment and the mechanical units as the type-writer and slow card readers are maintained by IBM.

The firm upgrades the system by using the newest accessories with it instead of buying the standard IBM units.

MAI tape drives are used saving \$43,000 over IBM drives on the larger equipment.

For the 1401s the tape drives are \$15,000 compared to IBM's \$37,000.

The manager further pointed out that down-time for the mainframe is less than 1% because diagnostic routines are perfected and the service engineers know the equipment cold. "In addition, the software is all ironed out and I have programmers who have never known a software problem."

He uses no reason not to buy well-used computers. "Those that have been run 24 hours a day, seven days a week couldn't have sloppy maintenance, and while these are the cheapest, we find they are good machines to have."

The corporation uses third generation equipment for new work which requires communication capability or large amounts of disk. The second generation is used for standard applications, particularly those that are tape or printer oriented since it finds no benefits from putting them on newer systems.

Scientific and engineering users do not find the second generation as much beneficial as do the commercial users because their central processor needs are so great.

One aerospace company contacted said that it has a 7090 but only because it got it on a lease/purchase option. It is being used for large, complex programs to be redesigned rather than emulated. The user admitted that the 90 was ridiculously cheap but said that it would be let go eventually because it presented problems in training and documentation.

Printers Scarce

One second-hand unit that is not available at particularly reduced prices is the

printer because this is essentially still a first generation unit. Also, the popular IBM 1403 printer has been in short supply.

John Losio, president of Electronic Business Machines, St. Louis, Mo., said that one impact of IBM's recent product announcements is that of the new printer which should shortly start making the 1403 available at better prices. There is talk in the industry about mainframe manufacturers using different methods to discourage their users from getting second-hand equipment. Commenting on this, Losio said: "Manufacturers are short-sighted to sabotage the used business. They should realize, as Detroit has, that a strong used market means a better new market. You're more likely to buy if you know resale is good."

According to Roger Hughes, president of Commercial Computers, Newport Beach, Cal., many users went onto third generation equipment in the emulation mode, thinking they would convert their work, but they haven't. They would rather put staff effort into new work and are finding that it is cheaper to put the emulation jobs back on second generation equipment and run it straight.

Prices Fluctuate

"The price of equipment fluctuates very much," he observed. "It depends upon whether the exact configuration needed is available or whether some units have to be bought new from IBM. This can add \$500 to \$20,000 to the price. Also, if a bundle of machines comes onto the market at once, this pushes the price down."

The IBM 1401s can be bought at 5% to 4% of original cost. Since IBM made 8,000 of them, they are in good supply. The 7000 series computers require more effort in locating since slightly under 1,000 were made.

Users Pay

Ironically, IBM is still leasing thousands of second generation equipment and their users are paying full price.

Bob Hogan, president of Summit Computer Corp., Summit, N.J., cites the case of two customers who were using 1401s leased from IBM - by becoming second-hand computer users they will save \$150,000 over the next three years.

In another case a user had a 360/50 at \$20,000/mo and was using it for nothing but emulation. By going back to a used 7074 he was able to cut rental to \$5,000/mo.

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Income Bill Lacks Safeguards to Information Access

By Joseph Hanlon
CW Staff Writer

WASHINGTON, D.C. — The Nixon administration has resubmitted its guaranteed annual income plan to the Senate. But in its rush to get money to the poor, it has continued to ignore their right to privacy of computerized personal information.

The new bill contains both computerized data banks called for in the old

bill [CW, April 22], still calls for extensive information exchange, and still contains no explicit safeguards.

The two new computerized data banks would contain dossiers on:

- All 24 million aid recipients;
- The 4 million people who would also have to register for training or employment services.

Two aspects of the bill would result in sharp increases in exchange of information.

First, joint state-federal administration of the program would mean that all information in state welfare files would be added to federal files. At the same time, much of the information in federal files would be passed on to the states.

Second, the bill states: "The head of any federal agency shall provide such information as the secretary [of HEW] needs for purposes of determining eligibility . . . or verifying other information." This and other parts of the bill mean that there will be a regular exchange of tax records between HEW and the Internal Revenue Service (IRS), a radical departure from present policy.

Under the bill, a wide variety of information could be collected and stored in government computers:

- Information relating to a person's "suitability" for employment.
- Data on "family and marriage counseling . . . and other services designed to strengthen family life."
- Extensive information now in state

files will be transferred to the federal government. There are presently no rules requiring that such information be relevant to the program, or that it be checked in any way.

Although a person denied aid has a right to a hearing, and then could correct errors in his dossier, there are many situations where a person might not have such an opportunity.

He might not be selected for a job, job training, or schooling based on such a file. But if he did not know he was under consideration, he might never find out that he lost out, and would have no reason to ask for a hearing.

Some people have been highly critical of the government for its failure to spell out safeguards in the bill. They charge that vague promises of confidentiality will not be effectively turned into regulations after the bill is enacted.

In effect, critics declare, the government has stated that welfare recipients have less right to privacy than others.

Mailing List Insecurity Scored

WASHINGTON, D.C. — Rep. Cornelius Gallagher (D-N.J.), Congress' leading foe of computerized invasion of privacy, hit the physical insecurity of computerized name lists in hearings recently before the House Postal Operation Subcommittee.

Testifying on behalf of his bill (HR 15309), a measure which would put strict controls on handling name lists for "junk mail," Gallagher cited the recent Chicago case [CW, July 8] in which three former Encyclopaedia Britannica (EB) employees were charged with copying computer tapes containing the names and addresses of two million EB customers and selling them to a mailing list broker.

Gallagher declared: "I believe this shocking example typifies the necessity for the Congress of the United States to begin to understand how vulnerable to abuse the computer is."

In Chicago recently, attorneys representing EB filed a petition in Cook County circuit court requesting a date for the preliminary hearing on EB's request of the reels of tape.

The EB injunction also asks that the tapes and all copies be returned, and that

an accounting be made of all profits resulting from the use of the tape.

Gallagher's bill has four main provisions: broker registration; a dissident computerized data bank for people who have indicated displeasure with junk mail; individual name deleting procedures; and source identification of names on each uncollected letter.

Confessions of a disk pack reject

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Editorials

Worthwhile DP Project

The attitude taken by government officials in the recent hearings on a national environmental data bank is not untypical: nothing to upset the applecart, nothing to make us think or work harder.

This is one data bank that should be established, one that could carry the slogan: the less privacy the better.

At least three different officials presented prepared statements calling the proposal "premature."

Sounds "late" to us.

We agree with the Murray State faculty member, who stated that there is no alternative to the data bank, and that computers can be used to manage it effectively.

We also agree with the officials of the state of Maine, who said, "The time for talk is past, the time for action is long overdue."

Letters to the Editor

Names Similar, But Different Products

Due to the similarity of our company name, Century Data Systems, Inc., to the NCR Century 100 computer series name, some misunderstandings are occurring with our customers and potential customers due to the article CW published May 27.

Although Century Data Systems, Inc. is one of the largest suppliers of high performance disk drives in the compatible 2314 market and in the OEM market, we do not presently supply NCR with our drives.

One of the prime design goals of our equipment was to eliminate the possibility of head crashes which, as your article points out, is a major problem with NCR and other manufacturers as well. We have shown that this problem can be minimized to almost an insignificant level.

W.J. Sewalk

Vice-President, Marketing

Century Data Systems, Inc.
Anaheim, Calif.

Matrix Operations Fundamental to APL

In your June 3 edition, Elaine Bishop's article entitled "Survey Shows Basic Often Limits User's Flexibility" ends with the statement (by two anonymous users) that "... the availability of matrix operations (a useful feature of Basic) in APL might some day bring about a switch to that language."

Please be informed that APL derives its power from its array-oriented definition and implementation.

All mathematical operations are applicable (without any explicit "MAT" statement) to arrays of any dimension. For this reason, matrix operations are not only available, they are fundamental to the very definition of APL.

For the further clarification of these and other non-APL users,

consider the following example of the matrix product of matrices A and B (of conformable dimension):

FORTRAN

```
DO 11 J=1,M
DO 11 J=1,M
C(I,J)=0.0
DO 1 K=1,N
C(I,J)=C(I,J)+
A(J,K)*B(K,J)
```

APL

C←A×B

From the above, it is evident that APL has full matrix capability, is easy to use, and is more mathematically oriented than procedural languages such as Fortran or Basic.

As I am certain that Computerworld wishes to present all the facts, I trust you will publish this letter and correct Elaine Bishop's statement.

S.M. Raucher

Washington, D.C.

D.C. Data-Line

Unemployed Can Turn to Job Bank

By Alan Drattell
CW Washington Bureau
WASHINGTON, D.C. — The data processing specialist out of work in metropolitan Washington can find assistance from the job bank, one of 42 such Department of Labor computerized operations throughout the country.

The Washington bank, which covers the District, suburban Md. and N. Va., lists between 4,500 and 6,000 jobs daily that are available in the area.

The positions offered range from busboy to systems analyst, and in the first nine months of operation, thousands of referrals of applicants seeking employment have been made.

There are no exact figures available for the period; however, in the first four months of operation better than 5,200 referrals were made.

Computerized job banks were introduced in 1968 when Baltimore became the site of a pilot project. Since then the banks have been extended to 41 other

Caught in the Middle



Alan Drattell

cities, providing service for more than 35% of the nation's labor force.

Expansion of the job bank was a key campaign pledge of President Nixon in 1968, and the Department of Labor says that at least 24 additional banks are expected to be operational by October.

While professional-type workers are served by the banks, the thrust of the effort is toward the unskilled, the disadvantaged, and those who have some of the skills necessary for employment but who need some type of counseling and aid to get them to the employment status.

Manpower training is a key element of the job bank program, and according to Adolph J. Slaughter, director of the Office of Community Relations and Information in the D.C. Manpower Administration: "The job bank is more equitable. It doesn't see black or white."

A Department of Labor official earlier said: "It is not uncommon to find that the placements of hard-core unemployed have as much as doubled [since the advent of the job bank], and that employers in large numbers who did not previously list their job openings with the public employment service are now turning to it in confidence." In Washington, 30 to 40 hard-core unemployed are placed each month.

In its simplest terms, the job bank functions this way: after a job order is taken over the telephone in an office of the U.S. Employment Service, it is entered into the computer to be

printed out in the job bank book — a computerized listing describing openings and training opportunities in the area.

In Washington, a service bureau, Computing and Software Inc. in Alexandria, Va., is used. The bureau has an IBM 360/30 with 65K core and three 2311 disks, four 9-track tapes and two 7-track tapes.

Eighty-four copies of the job bank book — averaging 220 pages — are printed and updated daily and sent to various Manpower Administration offices in the metropolitan region for use by counselors. Professional-type employees are given direct access to these books. The employment service offices receive and post notices of jobs available in other areas of the country.

A majority of the jobs offered in the District area are in private industry, according to Maurice L. Hill, director of the Office of Employer and Technical Services, and Washington has not been as hard hit by the current employment recession as other cities in the nation.

The program here, according to Hill, costs between \$250,000 and \$500,000 a year. Although the Washington operation has not come up with any figures indicating savings from the computerized system, Hill said the bank has released "professional people to do professional work and left the clerical tasks to the computer. Before the job bank we did everything by hand."

In some test areas in the nation, such as Utah, more sophisticated uses of the computerized service are in vogue, including the matching of men and jobs electronically. "The ultimate," according to Secretary of Labor James D. Hodgson, "will be to have a job bank capability in each of the 2,100 employment service offices in the nation, linked statewide, regionally and nationally." A fully computerized network is sought by 1976, and according to a labor official this could mean use of on-line terminals.



Answer to Cobol Overhead - Step 1: Cost-Accounting

Now that the idea of waiting until the fairy godmother comes around and presents us with a wonderful, Cobol overhead-free computer has been seen to be a bit unreasonable, the harder question comes up as to just what can be done to cut Cobol overhead.

The answer is far as I can see is not very straightforward, at least not for most computer installations.

Better Cobol does not come free, and an installation is going to have to work for it, and that work is going to have to be paid for.

Unfortunately, while the budgets of computer installations are quite substantial, they are normally set up as being service organizations. Money is provided for the hardware, for the payroll, for supplies etc.

Work is done on the computer for the various departments, the charges are allocated according to some agreed on formula. This shows up in the computer installation budget and has the effect of approximately 'cancelling out' the hardware, etc. costs, and everyone goes home happy.

The key here of course, is that formula. The way that the charges to the department are calculated.

Generally it is simply taking the amount of machine time used for the department, multiplying it by some magic number, and there is your answer. In somewhat more sophisticated cases it makes separate charges

for programmer time, printing on the fly, or other local interest points.

Practically never does it take into account the value of the work done. Instead it bases itself on the cost.

Efficiency Restrained

This type of accounting is currently holding back the progress

Alan Taylor, consultant, writer, and former editor of *Computerworld*, is president of Computer Management Aids Corp. of Framingham, Mass.

of computers, because it makes no provision for the installation to spend money in becoming more efficient.

In such a case, if the installation programmers turn around, put in 60 hours overtime, and cut the running time of the major job in half, the figures that the accounting department will produce will show that now they are only doing half as much work on that job as before!

Money has certainly been saved by the corporation, but the benefit has accrued to the user-department (which did absolutely nothing) and not to the computer department.

Resources Allocation

This is important—because when it comes to allocating resources management will use the figures from the accounting department to determine policy. So, if you want to gain ade-

quate resources to do anything substantial inside your department, then you are going to have to see that if you do some good, then it is going to be attributed to the right sources.

This then is the first action that you can take. Pick the most heavily used run that is currently on your computer system, and imagine that it is cut in half. Then go down to some friendly soul in accounts, and with his help work that into a set of the company internal accounts (hypothetical ones, of course) and see in just what column it ends up.

Then take a second step. Imagine that to make this saving you had to spend 10% of the annual saving, and that you spent it in the month preceding the new program working. Now, with your friendly accountant back that into a second set of hypothetical accounts. Then look at the results.

Probably they will say that the more efficient you run that computer system, the worse the management picture of your department will be!

Ask Accounting's Help

Then comes the key moment—because this is where if you have chosen the correct fellow down in accounting that you get an absolutely needed ally. Don't get annoyed and say that accounting ought to know better—instead just sit back, and ask your friend just what is modern accounting for?

Ask him to tell you about his theories and ideas as to how accounts could, and should be used. Suggest that you have

The Taylor Report

By Alan Taylor



heard somewhere that accounting is not just to know what money there is in the bank—but that it has a vital management function.

If you have chosen correctly, you will still be sitting there

listening for quite a time. Most accountants believe that the form of the accounts can greatly influence the success of an organization—but they all too rarely have the opportunity to set up a set of really good accounts. Many of them want to, but the current set in the firm are not too bad, so why disturb them?

You may have provided the answer. If you get him to compare the cost of the computer department to the annual profit of the firm, you will have given him the final touch to answer. You may have shown him that while efficiency in the computer department can make a substantial contribution to that annual profit, yet the way the accounts are currently set up hinders, rather than helps the computer department in becoming efficient. Then you can together get working on developing a better set of accounts.

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COMPUTERWORLD

Pioneer Conference Gives Few People Few Answers

By J.H. Bonnett
Los Angeles Bureau

LLANDUDNO, N. Wales—What have the pioneers of computing to contribute to tomorrow? This was the fundamental question posed by a two-day seminar addressed by 10 of the best known names in the business held here earlier this month.

Are their ideas still fresh, what can we learn from their experience? These were the questions being asked, and to which we can have no meaningful answer as the conference turned out to be one of the most bizarre events ever held in the name of the computer.

Over 30,000 invitations were sent out by the organizers, Computer Consultants Ltd. and it was claimed that up to 2,000 people would attend.

This claim worried the residents of this sleepy seaside holiday resort, a tribute to the endurance of Victorianism, and now used mainly by the old and those unable to face the pace of the Costa

Brava.

The need not have worried. On the opening day organizer Richard Williams admitted that there were only about 60 paying delegates, and head counts at people out of a total audience of 45 or so who might have paid. The location of the event was changed from the venerable Pier Pavilion to that of Caesar's Bar, a sort of night club on the ground of the Grand Hotel, next door.

The seminar fared better than the accompanying exhibition, held in the Winter Garden Ballroom, which attracted about eight exhibitors including Univac, General Electric, and ICL. Of these, ICL was the worst; it wasted no manpower, never staffed its stand, and relied on a display of photographs.

The exhibitors who were present soon became discouraged; one claimed that in the first three days only 17 people attended.

At the conference hall the speakers ploughed on regardless and first to break the ice was Professor D.B.G. Edwards—of Manchester University. A veteran of the Ferranti MK1, Mercury and Atlas, he is now engaged in the development at Manchester of a new machine, MUI, which many believe will be the prototype of ICL's next range. For the future he saw the greatest prospects in associative memory techniques, a subject to prove popular with several other speakers.

Ed Berkeley took as his theme "Sense and Nonsense in Computer Applications," and after a lengthy review of his own part in the history of computing—a course followed by most speakers—said people must be concerned, for it is their responsibility. He asserted that computers do think, and that computers will translate from one natural language to another, and that every defined individual operation can be done by a computer

better and faster than by a human being, and that it is possible for a computer to make decisions more wisely than a human being.

The first morning was concluded by a speech from Dr. J. Presper Eckert who reviewed the history of computer and memory generations. He predicted that memory costs will drop by a factor of 10 in the next five years and that the 100- μ sec memory of the plated wire type built experimentally by Univac will be in common use, LSI in the view of Eckert, is still anything from two to 10 years away.

Dr. F. Filippazzi, an Olivetti veteran and a member now of GEIS Italia, presented a historical account. In Italy, he said only 1,500 machines are now installed and 65% of these are small, and only 5% large, though the trend was towards larger machines. Of machines currently installed in Italy, he said 10% are in universities, 10% in public administration, 20% in banks, and 50% in manufacturing industry.

Grady Grace Murray Hopper pinpointed the mistakes made and what must be done to correct them. A prime mistake, she asserted, has been that of the mathematicians and scientists in isolating the user from the machine in the past.

For the future, she said, new ideas are not welcomed with open arms and a million dollars, but must be promoted by any technique available. Off the terminal scene she said: "Management will never do it themselves—they won't even get their own telephone numbers."

She looked forward to a future making full use of modularity, and many small computers, and the modern massive high-speed CPU being seen as a dinosaur. In terms of software she said: "We must get rid of the file drawer concept if we are to make proper use of the large stores now becoming available."

Other speakers present included John Hargreaves of IBM UK, T.R. Thompson, a veteran of the Cambridge Edsac project and of the Leo computers, and Dr. Konrad Zuse. Summing up, these pioneers by no means feel that computing is anywhere near its final destination, though their individual views on the future vary and they emphasize that we of the present have a lot to learn from the past and that all the ideas of the past have not yet been exploited.

IS the international marketplace the key to success in the computer industry at a time when things aren't going so well here at home?

The current Gray Sheet probes this concept as it examines as the world of the computer outside the U.S. Send for the current issue — \$8. Or, go ahead. A year's supply only costs \$75.

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July 29, 1970

Page 11

DNA 1130 Sort Package Gives File Structure Choice

FLINT, Mich. — IBM 1130 users are said to have almost complete choice of file structure, extreme flexibility of sort-key format, and exceptional speed with a sort package available from DNA Systems Inc. for less than \$500.

The sort is a joint development of DNA and Electronic Computer Pty. Ltd. in New Guinea, a DNA spokesman said.

The package is capable of handling Fortran organized files, RPG sequential files, or files created under DNA's Disk Control System. However, all the files must have fixed-length records, a DNA spokesman noted; and some files cannot be sorted with the package.

A maximum of 430,000 records can be sorted at one time on an 1130 with a single disk drive. A multistage system can process 509,440 records. In either case, DNA said, an unlimited number of sort-keys can be used.

Sort-Keys

The sort-keys can include sin-

gle-and/or double-word binary integers, or paired binary patterns of from one to 32 contiguous bits, which may be spread across three consecutive words.

Other possibilities "include floating point, standard or extended precision numbers, or Fortran A1, A2, A4 or A6 data of any length, Ideal Cram A3 and Commercial Subroutine D1 or D4 data of any length can also be used, as can RPG A2 or RPG packed data in any length. According to DNA, the package's speed allows a 12,000 record file, with 16 word/record and random organization, to be sorted in place on 16 integer keys on an 8K, 3.6 μ sec 1130 in about 10 minutes. Partially ordered input data and/or larger core size would improve this performance.

One user said he used a mixed alphanumeric six-word sort-key on a 4,000 record Fortran file of 24-word records and completed the job in two minutes.

Functionally, the basic package

is a stand-alone sort that uses control cards to define the file organization, identification, record size, file size, sort-key, and other necessary parameters.

Two Options

DNA can provide two modifications to the basic sort. The spec-file option allows the user to put his sort specifications into

a file, and to call a subroutine to initiate the sorting.

The second option, roll-out, gives the user the capability to roll out core to a save file set up by the user, sort the user's file, roll-back core from the save file, and continue execution of the user's problem program at the next instruction.

Cost of the basic stand-alone

sort package is \$495 under a license agreement. The callable spec-file and roll-in/roll-out options are available for an additional \$45 each, according to DNA.

Electronic Computer Pty. Ltd., on Boko St., East Brooke, Papua, New Guinea. DNA Systems Inc. is at 2415 W. Stewart Ave.

EUROPE TODAY

Issue 12. France had over 5,000 computers installed at the end of 1969. More than 50% of these were small card-based systems: Bull-GE holds 25% of the total French market. These two points - plus others - are studied in Issue 12 of **EDP Europa Report** which concentrates on the French scene and the Honeywell-GE merger.

Order your copy of **EDP Europa Report** Issue 12 now, at the non-subscriber price of \$5 (£1.15) USA, \$3.35 (£1.85) Europe and have its full value accredited to an annual subscription for 24 issues \$65 (£27) if taken up within two months. Orders may be placed at either of the following offices.

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2 Ennis Brandon Services Designed for CPA Support

FORT WORTH, Texas — Accounting firms whose practice includes financial services for small- and medium-size businesses can now use either of two services from Ennis Brandon Computer Services (EBCS).

The services, EB 20/200 and EB 30/210, are said to provide only the essentials required for small businesses, so that the CPA can give his clients the benefits of a computer service at a cost "well under that of manual work."

Both services provide as standard reports a transaction-posting register, trial balance, balance sheet, and income statement. EBCS added that standard options, at no charge, include dollar rounding and percentages on the income statement.

Extra cost features include preparation of an employee wage and tax report and preparation of W-2 and 941-A forms, in addition to preparation of the balance sheet and income statements on white bond.

The basic difference in the two services, EBCS explained, is in the form of the input data. Under EB 20/200, the Brandon Center prepares the data from the user's source documents.

EB 30/210, on the other hand, is for the firm whose volume justifies a keypunch or key tape unit in-house, in which case the preparation costs at EBCS are virtually eliminated.

The services can be used interchangeably with each other, and they can also be used with the EBCS General Ledger System, Brandon said.

The company estimates that processing for the CPA services will be under \$10 for each of the accountant's clients. A four-day turnaround can be considered

normal, EBCS said. Ennis Brandon Computer Services' headquarters are at 2840 Walnut Hill Lane.

Packages Offer Cobol Support

SACRAMENTO, Calif. — Cobol users can gain documentation, housekeeping, and report formatting support from a series of packages, Easyflow, Date/Sub, and Check-Pro, available from Rodger, Rogers and Kirman (RR&K).

As an aid to documentation, Easyflow generates management level flowcharts based on input data developed from rough flowcharts. Logic changes, shown by simple changes in the input documents, will generate complete new flowcharts, RR&K said.

The Date/Sub subroutine is designed to convert dates back-and-forth, as desired, between the Julian and Gregorian calendars. This package will also convert the date to the day of the week on which it occurred, according to an RR&K spokesman.

Check-Pro is said to convert any dollar amount to the equivalent alphabetic spelling. With values spelled out, RR&K said, checks cannot be tampered with or misinterpreted.

Check-Pro can be used on any CPU that supports Cobol, the developer said. It requires 1.5K to 2K bytes of storage and costs \$95.

The Date/Sub subroutine also sells for \$95. The Easyflow purchase price is \$225, including complete documentation and user's manuals.

Rodger, Rogers and Kirman is at 2410 K St.

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Shhhh...

PEC

FCC Seeks Comments on NAS Interconnection Report

By Don Leavitt
CW Staff Writer

WASHINGTON, D.C. — The FCC would like to hear reactions to the interconnection report recently submitted to the commission (CW, July 1) by the National Academy of Sciences (NAS).

The report was based on studies authorized by the FCC as an outgrowth of the Carterfone decision in 1968. NAS told the commission that the carriers have been slow in providing the devices required to connect non-

carrier equipment with the phone network. On the other hand, the report noted, inclusion of protective devices directly in to non-Bell terminals might be difficult because of differences in equipment design.

The academy also highlighted the lack of information exchange between carriers, users, and others involved in interconnection. Apparently in response to that point, the commission has now asked for comments on the "significant technical findings and conclusions" contained

in the report.

Copies of the report are available from the National Academy of Sciences, 2101 Constitution Ave., for \$4.50 each.

The FCC has said that it will

delay taking any action on the report until it has heard from all interested parties, including an independent consultant that the commission itself has retained to analyze the NAS findings.

Written comments (an original and 14 copies) are requested by Sept. 1, the commission said, and should be addressed to the Chief, Common Carrier Bureau, at the FCC.

Whitehead Expected to Get OTP Nod

WASHINGTON, D.C. — The Senate's expected confirmation of Dr. Clay T. Whitehead to be director of the Office of Telecommunications Policy (OTP) brings that office, added to the

White House staff earlier this year, closer to full operation.

What the new directorship will mean to the teleprocessing user is still unclear. None of the announcements to date have

made specific reference to data transmission questions. Whitehead's background gives no clue as to his thinking in that area of telecommunications policy and he was unavailable for comment.

Whitehead has been on the White House staff since the start

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of the Nixon Administration, working with the Rostow report on telecommunications, and international and domestic satellite policy, and drafting the Administration's reorganization plan under which OTP came into existence.

Whitehead agreed to take on the OTP directorship only after his own choice for the job, William Niskanen of the Institute of Defense Analysis, ran into opposition.

Although the OTP is supposed to be an advisory body, its impact could be significant. When the office was first proposed, Whitehead felt that OTP "will not affect the responsibilities and authority of the FCC." On the other hand, White House "fact sheets" distributed at the same time said the office would prepare "administrative recommendations to" and have "effective cooperation with" the FCC on "policy matters."

Intentionally or not, "administrative recommendations" are almost sure to effect the FCC's work.

Sangamo Has New Modem

SPRINGFIELD, ILL. — A data modem has been designed by Sangamo Electric Co. for originate-only Teletype applications to 300 bit/sec, full duplex on the DDD network via the Bell data coupler F57051 or 1000A.

The T113ATS can replace the Bell or Sangamo 103A2 or 101C modems and sells in small quantities for under \$200, the company said.

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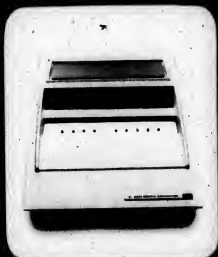
COMPUTERWORLD



1970 MINICOMPUTER SUPPLEMENT

July 29, 1970

Supplement/Page 1



mini

Price is the only thing cheap about the minicomputer.

Proliferating at a fast pace, the small, low-cost, high-speed computer has found its way into more than 10,000 installations to date, with total minicomputer shipments expected to reach \$700 million per year by 1975.

Digital Equipment Corp., with an estimated 60% share of the current market, presently reigns as king of the minicomputer hill. Yet, because the mini has made it possible to computerize many small jobs on an economical basis for the first time, applications have expended rapidly and a host of new companies, all vying for a piece of the action, have appeared.

Current leaders in the field are Hewlett-Packard, Honeywell's Computer Control Division, and Varian Data Machines, with several young firms like Dete General and

Interdata coming on fast.

The biggest reason for the so-called "mini-boom" is cost. Large-scale computer systems may price in the millions, while the typical minicomputer — a parallel, binary processor with 16-bit word length, 4,096 to 32,768 words of magnetic core storage, and 1- to 1.5-sec cycle time — can sell for less than \$5,000.

Minicomputers can perform many functions previously sacred to full-scale computers, be incorporated in complex computer system hierarchies, interface with many kinds of devices, and operate in a time-sharing mode.

In this supplement *Computerworld* examines the characteristics, applications, features and drawbacks of the mini, showing why, to the small- and medium-scale user, it is perhaps the cheapest and most effective aspirin for his EDP headaches.

Big Daddy to the Mini?.....Page 2

Minis Mean Business.....Page 6

**Product Tests Optimize Mini Use
.....Page 10**

**Minisystems Through Peripherals
.....Page 12**

**MSI Aids Modular Assemblies Design
.....Page 15**

Began in 1944

Minicomputer's History Traced Back to 'Whirlwind I'

By Don Strong
CW Supplement Editor
Let's not question the mini-computer's papers.
This low-cost, high-speed ma-

chine which is able to perform most functions previously sacred to larger computers, now appears to be of royal blood.
Having raised the eyebrows of

many who considered it the son of several earlier mainframes, the minicomputer's parentage is now clear. On-Stage EDP family tree the mini branches back to a stately old gentleman named "Whirlwind I."

One of the first high-speed stored program computers and a contemporary of such old-timers as Edvac, Secac and Univac I, Whirlwind I not only bears the strongest resemblance (apart from size) to the minicomputer, but also pioneered several aspects of present day computer hardware and software, including the invention and development of magnetic core memory.

For example, as the first large-

scale, general purpose, digital computer engineered to operate on real-time problems, it was probably the world's fastest computer in its time.

In its initial version with electrostatic storage, Whirlwind I could perform 20,000 operations/sec. It had a word length of only 16 bits, but the arithmetic unit was implemented in such a way that, when necessary, results containing up to 32 bits could readily be handled. It also included a software package that provided for multiple precision and floating point arithmetic.

Analogs to Digital

Whirlwind I's history actually began in 1944 when it was originally conceived as the computing element of a universal flight simulator to be developed for the Office of Naval Research. The computing demands of the aircraft simulator required a degree of speed, flexibility, and precision which MIT's Servomechanisms Laboratory found unattainable by analog means. Accordingly, they decided to build a digital computer.

With the development of basic components and circuits over the next four years a machine of enormous size evolved, possessing many of the technical and operational traits inherent in today's so-called "desk-top" minicomputers. This was Whirlwind I.

Whirlwind I initially had electrostatic storage tubes with a capacity of 256 (16-bit) words. Its input/output facilities consisted of a Friden Flexwriter plus a photoelectric tape reader. Later in its development, Whirlwind I's electrostatic storage was replaced through the first use of magnetic core storage (2048 words), which not only resolved problems of storage reliability then threatening the success of the whole project, but also greatly increased the computer's operating speed.

In the following months a more efficient input/output system was installed and additional I/O devices were provided. These included an auxiliary storage and magnetic drum, with 24,576 word capacity, a buffer storage magnetic drum for handling radar input data, display

oscilloscopes, and digital magnetic tape units.

Impressive Credentials

Other Whirlwind I pioneering achievements included:

- Development of the preventive maintenance technique called "Marginal Checking," a procedure for enhancing reliability by pinpointing deteriorated components before they failed.

- Development of techniques for the numerical control of machine tools.

- Development of simplified programming techniques through which conversion programs and other general-purpose routines were instituted to aid programmers in debugging programs.

Whirlwind I also provided the first large-scale, real-time control system. From early experiments in tracking aircraft by digital computer, the Cape Cod system was devised, with Whirlwind I as the control element.

The system was a network of radar sites feeding data to the computer. It detected and tracked target aircraft and transmitted vectoring instructions to scrambled fighter interceptors.

These techniques were later incorporated into military air defense, including the Sage system for which Whirlwind I and the Cape Cod system were the prototype.

Since as many as 16 manned consoles could interact simultaneously with the central computer, Whirlwind I can be hooked upon as a time-sharing forerunner.

In the spring of 1959, MIT's two primary users, the Digital Computer Center and the Lincoln Laboratory, decided Whirlwind I had spawned its own replacement and there no longer was a need for the machine. The World Research and Development Corporation (WRDC), of Bedford, Mass., later indicated an interest in the computer and leased the entire installation from the Navy.

Recently the Smithsonian Institution in Washington, D.C., acquired title to Whirlwind I and plans to transfer important elements of Whirlwind I hardware and documentation to the national archives.

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Dwarfing the minicomputer, Whirlwind I nonetheless pioneered several aspects of present-day, small-computer hardware, including the development of magnetic core memory.

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Managers Speak Out on Minicomputer's Future Role

By Don Strong
Computing Editor

Commenting on the role of the minicomputer, a Honeywell spokesman perhaps put it best when he said: "As in the selection of any tool, the purchaser must consider its use. You don't buy a high pressure-high volume pump to rid your basement of water. Nor do you use a basement pump pump to bail out the Queen Elizabeth."

To evaluate just how big and what kind of a splash the mini is apt to make in the next few years, CW held a captain's meal of its own with four men responsible for charting the course of small computers.

Q: Is there a mini revolution?
Loper: Prices for computer hardware have come down in an expected fashion. Consequently, there are large numbers of manufacturers of such hardware in anticipation of a mini revolution. Yet, such a revolution cannot occur in totality until peripheral costs for minis have come down to an equivalent level.

Rawson: Actually, the mini revolution is no, more a revolution than the introduction of any new device. It's lesser one because computers have always been available. Now, they are simply being offered in a smaller package.

Hog: Well, if it isn't a true revolution, it certainly is rapid evolution. Depending on the definition of the minicomputer, 10,000 to 15,000 have been shipped to date, and by 1975 experts predict shipments of 30,000 or more each year. There are some holdups to the minicomputer's growth however. For example, shortages of real-time programming personnel, and a need for better understanding the applications to which these machines can be applied.

Q: Is the mini really a flexible, "can-do" time and money saver?

Kenney: The minicomputer is truly a "can-do" machine, yet it can only be a tremendous money-saver if the user keeps in mind the objective of the user. The total costs, consisting of design, system

"The minicomputer can be defined as a general-purpose computer which can perform more than one add per second for every dollar of CPU price."



Donald P. Kenney is program manager of Data Systems and Equipment with the Mobil Oil Corp. He is responsible for directing a program to evaluate, test, and install data systems and equipment at worldwide corporate locations.

development, programming, test installation, scheduling, planning, backup, and maintenance for all its systems.

Loper: The minicomputer is flexible only within a narrow range of definitely mini-oriented applications. It is fair to say that a minicomputer is anywhere as flexible as a larger, more costly computer system, with such things as time-sharing and on-line Fortran.

Hog: How much time and money can be saved is a function of the application to which it is applied and the way it is used in the application. However, the growth of the minicomputer market seems to indicate users believe the computers are saving money, improving results, or in other ways, pay their way.

Q: Is it an independent mainframe with I/O capabilities?

Loper: Mini manufacturers vary on the

amount of interface equipment supplied with a mainframe. Most, however do not have with I/O capability attached, but with merely the potential for attaching I/O interfaces. Users should determine the amount of interface capability supplied with each mainframe when doing competitive pricing.

Q: What should a minicomputer cost?
Kenney: \$20,000 should define the price limit. And, they will cost less than \$5,000 probably tomorrow. However, a definition on price bothers me a bit. The mini is no less a computer than the one many of us knew 10 to 15 years ago. Only the price has changed. Maybe we should bring performance into the definition, such as defining the mini as a

"Software will undoubtedly cause the largest problems in the integration of a minicomputer system."



F. Gail Loper is manager of product development with The Foxboro Company. He is responsible for directing systems engineers and programmers who develop the company's digital systems product line.

general-purpose computer which can perform more than one add per second for every dollar of CPU price.

Hog: I think we sometimes get tangled up with CPU price. A computer is only useful when it handles I/O and/or peripherals and is programmed to do something. The reduction in CPU price does affect overall system price. However, many cases the CPU is an insignificant fraction of the installed, programmed total system price.

Rawson: Probably within five years we will see mini system costs lower than \$10,000, however there is no question but what a CPU can be purchased for under \$5,000 at least by that time.

Q: Can the mini be programmed by user personnel, or is it an ultra-sophisticated systems device?

Loper: Minicomputers very definitely require experienced programmers, unless the application requires only the use of computational capabilities, provided by a compiler-type language.

Rawson: Most user personnel are going to have difficulty programming these machines. It's not an ultra-sophisticated machine. Instead, it's a very useful systems device that will not be organized for utilization by user personnel.

Hog: I disagree. Most minicomputer systems are programmed by user personnel. The user who is applying it knows more about his system than the computer manufacturers. Many minis have considerable software to assist the user, such as exec utility routines, peripheral handlers, Fortran IV compilers, etc.

Q: Is it appropriate for time-sharing only, or not at all?

Loper: Expansion of a minicomputer to be able to handle time-sharing will certainly price it out of the minicomputer bracket. It is possible, however, to develop time-sharing type software for minicomputers.

Rawson: The mini is appropriate for anything you can figure out to make it do.

Hog: The mini is appropriate for small time-sharing systems, process control, laboratory work, communications, for almost any application.

Q: Will minis replace or supplement bigger, more expensive hardware now in use?

Kenney: Both the mini and the large machines have their place in the large company. The mini will never replace the larger mainframe but rather will complement it. The minis are assured of their place in the laboratory, in manufacturing, and in communications.

Loper: In many cases minis will replace larger systems in those instances where users have over-bought hardware, thinking that in the future they would need the extra flexibility which this would buy them. Realistic users may tend to buy smaller machines and add more CPUs to their system, rather than add to an

"How much time and money a mini-computer can save is basically a function of its application."



John Hog is product manager for industrial control systems at Honeywell's Computer Control Division. His responsibilities include planning and coordination of division activities for Honeywell's Series 16 industrial control computer system.

existing larger CPU. In those cases, where expansion eventually becomes necessary, the user will, undoubtedly have saved capital expense.

Hog: Minis will replace some very old control computers and will be put in to provide added functions to existing installations. In at least two cases, we have found it more economical to put in a minicomputer system than to expand an older - out of production - system. Yes, the mini is able to "talk" to the older system.

Rawson: They will certainly make a lot of inroads on bigger and more expensive hardware, simply because they are less expensive and are competent enough to do the job economically.

Q: Can the large company find true integration with the mini as a free-standing or integrated unit?

Loper: Very definitely, providing the pay-back objectives and technical scopes are kept small and realistic, and the job's scope is not allowed to grow appreciably beyond the implementation phases.

Kenney: There is great potential for minis entering business data into our large systems and for stand-alone systems for some non-mainline applications.

Hog: There is no question that the mini will find wide use in the large company as well as the small firm. They may start out as stand-alone systems, but eventually will get tied into larger computer systems that are looking at several related operations.

Q: Is there a trend toward centralization?

Loper: A trend toward centralization of high-order functions definitely exists in the computer control industry. Such functions as plantwide optimizations, and production scheduling will be placed in a centralized system, while the minis will be used to handle small high-frequency, low order tasks.

Hog: The mini helps the trend towards centralization. In almost any operation, to centralize, cables must be run to bring real time data to the central location.

If one time to read 100 temperatures for example, 100 pairs of wire need to be run to the central location. However, a mini

can stand out near the temperature sensing devices; scan and monitor them; and send pertinent data back to the central location via a few pairs of wires.

Q: If the mini can be integrated into existing automated systems, what modifications are necessary, and will the cost of integration make it feasible?
Kenney: It is a continuing objective to capture the data as close to the source as is economically and operationally feasible. Since the mini will replace hardware, the flexibility of the mini makes it an asset for integration.

Hog: The mini can be integrated into existing automated systems, but only if it makes sense to do it. In many cases, the present automation system may be doing a good enough job so that a computer isn't required.

Rawson: Compatibility with a computer will be a big factor in determining the costs of integration with the present automated system.

Q: Where do the real costs of integration lie - hardware, software, or interface?

Loper: Software will cause the largest problems for integration, along with interface problems in hardware. Consequently, the user must realistically estimate his costs to determine when the minicomputer system really is the cheapest way to go.

Hog: Installation costs will also run high - depending on the number of cables to be run and their length. Another cost may be the study of the process to be controlled. If this is a well-understood process, or has been automated before, the study may be minimal. If it is a new or poorly understood process, study costs may be most significant of the entire integration problem.

Kenney: The total life-cycle costs of minicomputer systems should always be carefully planned and controlled, in particular, software costs.

"The difficulty with decentralization is that you must have competent people to operate smaller computers or you have to have a well-engineered system."



Edward B. Rawson is vice-president and technical director with Searle Medidata, Inc. He is responsible for supervising the development of his company's hardware and software products.

Rawson: The costs would appear to lie everywhere, but the user must consider the fact that he has to expend money in all three areas and not concentrate funds simply in one direction.

Intermediate Language

Intermediate Language (IL), a new software product designed with the minicomputer in mind, now permits programming at a level of detail, intermediate between Assembly Language and conventional higher-level languages.

Recently developed by Evans Griffiths & Hart, Inc. of Lexington, Mass., IL makes it possible to write algorithms and conditional statements as in higher-level languages, but with complete control over the code generated utilizing all features of the machine.

'A Computer in Every Home' Possible With Mini T/S

By James D. Bailey

Special to Computerworld

If the often made and just as often debunked prediction of a computer terminal in every home is ever to become a reality, it could well be through small computer time-sharing.

The small computer-based time-sharing system is perhaps the best example of what the small computer can be made to do when state-of-the-art software technology is applied.

One application that invariably is made in a discussion of small computers is that they are hard to program. The availability of a variety of applications for a mini-computer system with 16 terminals, eight different program languages, and such peripherals as paper tape reader and punch, magnetic tape storage, and disk storage, would seem to refute this. On the other hand, the time-shared programmable calculator refutes the statement that these devices are nothing more than adding machines.

Small computer time-sharing actually means three different types of systems. There is the shared programmable calculator; the small computer-based, single language system (supercalculator); and the true multi-purpose system. All owe their availability to the software technology that has evolved for the large computer.

What has tended to slow growth in this area of the computer technology is cost. By themselves, small computers are cheap. So are programmable calculators. Anyone offering a small computer-based time-sharing system must offer it at a per terminal cost below the cost of an individual small computer, or below that of the individual programmable calculator, at the small end of the spectrum. Similarly, both systems must have a per terminal price at least competitive with that offered by the time-sharing utility.

The most often quoted per terminal cost for small computer time-sharing is \$5,000. That is to say, the small number of terminals interfaced to a programmable calculator will cost about \$5,000 each, as will the large number that can be interfaced to a single language, small computer-based system and the even larger number that are available in the multi-purpose minicomputer-based system.

Priced the Same

Since minicomputer time-sharing is priced about the same as the time-sharing utility's terminal, the question is why would anyone want it when they can get that terminal for the same price? The answer is versatility. If an application involves pure arithmetic, the shared programmable calculator might do the job better. Here, several persons share a cost that amounts to an electronic slide rule. The disadvantage of this system is that calculators are hard to program, often requiring an extensive knowledge of machine and assembly languages. Also, there is no program sharing and no program storage.

The single-language system or "supercalculator" makes use of far more easily learned languages like Basic or Focal. Not only do these languages allow for number manipulation but also permit the use of letters to make words.

Calculation is more efficient because numbers and words are used. Longer programs can also be written, but the size of the problem to be solved is limited, and there is no on-line program storage. The key advantage is the simple languages.

The multi-language, computer-based system leaves the limitations of the calculator and "supercalculator" behind. It permits considerable on-line storage and the execution of long programs. It is often used for the same reasons as the other systems but on a higher level, as well as in totally different applications.

These systems take their lead from large

time-sharing systems, providing as much as possible the same capabilities. The major differences are program execution time, the ability to handle very long programs and large amounts of data, and



James D. Bailey is a marketing specialist with the Digital Equipment Corp. He is responsible for sales support and systems design of the company's TSS/B computer-based, time-sharing system.

limits on the number of users to about 16. These systems are often purchased to complement an existing batch-processing computer.

Perhaps the device around which the first two systems are built would better

be called a computer than a calculator, and the central device of the minicomputer a logic system for lack of a better term. In the first two systems, the central device computes. This is not so in the third. Perhaps we can illustrate this by using education as an example. The calculator and "supercalculator" are more than adequate for teaching mathematics and computer programming. Here, the student must prove he knows algorithms or algebra, so he literally teaches what he knows to the computer.

Applications Will Expand

As more people discover the existence of minicomputer time-sharing, its uses will expand. Primarily, these will be convenience-type applications, the kind that do not require a computer and could be done on large systems if the price were lower. Today, it is possible to offer computer time for \$3 to \$4/hr., and future prices will be lowered to \$1 to

\$2/hr.

Because future minicomputer time-sharing system prices will come down, the result will be more intelligent, students entering college and better prepared college graduates entering the business world. Businesses will make much more liberal use of the computer due to systems like these. Many will take the attitude that they cannot afford not to have a computer terminal for every technically-oriented employee. And, the computer will enter the home on a larger scale than ever before.

While the roles of the small and large computer-based, time-sharing systems will continue to differ, they will become closely associated. The large computers operated by time-sharing utilities in the years ahead may no longer "talk" to terminals at all. Instead, they will be interfaced to minicomputer time-sharing systems.



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Business Applications for Minis Will Keep Growing

By Philip C. Davy

Special to Computerworld

The minis are on the move, but what are the implications for users of business data processing?

In the next five years the business applications for minicomputers will be an order of magnitude greater than all others. And there are some very good reasons.

The need for automation in general business and accounting operations has begun to dawn on the small businessman (\$500,000 to \$10 million). He must often compete with larger firms which have tremendous resources and purchasing power, and are much more efficient because of the extent of their automation.

Turning Tide

The image of the computer monster in the multi-hundred thousand dollar bracket has in the past intimidated small business management, which has had to compete by virtue of greater mobility, more service, and the convenience of a nearby location. But the tide is turning.

The torrent of publicity on minicomputers, the proliferation of computer seminars for management, and the powerful marketing techniques of some of the mini-makers are beginning to have a profound impact on John Q. Small.

Add to this the fact that he is required to keep elaborate records by force of law, and must perform unremitted accounting functions for local, state and federal agencies, and it spells motivation with a capital "M." Then the inventory control dragon is beginning to breathe smoke in his face, as technical advances geometrically spawn new generations of products and services.

Irreversible Trend

Net effect? The word is getting around in small business circles that you have to have a computer to survive.

But with it is coming the realization that the computer may not take up much more space than a typewriter and its stand, and that the cost can be amortized in a few years. This message, and the technique behind it, have established a trend which will not, and cannot, be reversed.

Nature of the Beast

The potential users of minicomputers form a broad-based pyramid divided into five levels. The top segment of the pyramid includes large companies, and the bottom represents the smallest firms. At the top is the group which now uses large EDP systems. The next level down uses small EDP systems.

The third segment includes firms which use only word processing equipment. On the fourth level are the users of accounting machine systems, both electronic and electromechanical posting and billing equipment.

At the base of the pyramid, comprising the largest proportion of the potential users, are those firms which are using self bookkeeping methods, possibly with some assistance from

independent bookkeeping and accounting services.

Any of these levels might use service bureau assistance. But operating with a service bureau can include drawbacks and difficulties.

A variety of data. Few firms are happy about allowing confidential operating information to get out of their hands.

Changes to procedures. Few outside services tailor their packages to the customer's operating methods, and adaptation tends to be all the other way.

Loss of convenience. Data delivered to the service bureau is not available for reference and analysis while processing is under way. Several days may be required for turnaround.

Time-Sharing

Time-sharing may be able to eliminate some of the problems of using an outside service bureau. However, time-sharing services are not without their own problems.

Terminal equipment shortcomings. Teletypewriter terminals are not well suited to business data entry and printing operations.

Communications volume. The sheer mass of business data to be transferred can cause communications costs out of proportion to the services gained.

Wrong emphasis. Most available time-sharing services are oriented toward scientific and engineering applications.

The implication here is that, with their present orientation, and with existing terminals, the time-sharing services are not going to make mighty inroads on business data processing scene.

Enter the Minis

It's significant that the minicomputer can fit anywhere for the user. At the top of the pyramid it can function as an intelligent front end, or satellite to a large-scale system.

At the next level it will, if sufficiently modular, be directly competitive with the smaller EDP systems. Continuing down, the minicomputer can replace both unit record and accounting machine systems in their present forms.

Mini and T/S

However, time-sharing services need not render the minicomputer as an enemy. Some recently announced systems even employ the mini as a remote batch terminal processor. Terminal processors promise to be very effective in reducing system costs by virtue of their buffering, formatting, and editing talents.

The "intelligent" terminal processor itself can time share its facilities and control several independent terminal devices. Thus these types of minis may open up profound new business possibilities to the time-sharing people, by giving them a terminal which meets a wider range of applications.

On the other hand, the non-computer accounting systems are definitely coming under attack by the marketplace that has been enhanced by the emergence of the minicomputers. The price of minicomputers is such

that the electronic accounting machine (EAM) system, which makes them highly vulnerable to this mini competition, since the errors in the system are directly proportional to the number of operator functions performed.

If the volume of work increases, a firm has to add another \$8,000 to \$20,000 machines. Each machine only handles so many forms and records

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to do, so identical units have to be added to expand capability. If there are several different functions to be performed, separate machines may be required. In contrast with this, say, \$20,000 minicomputer system with a small CPU, A4 magnetic memory, paper tape reader or inexpensive magnetic tape unit and an interactive form printer. System throughput can be doubled merely by adding a second interactive printer for the output of the system. With additional work stations the savings increase proportionally. Additional user programs can allow multiple stations to be

processing a number of separate jobs without interference.

In a system organized around a general-purpose CPU any of the user stations can be accessing the same data base (e.g. customer and inventory files) or even building a file in common with other operators.

Unit Record

The same realities impinge upon the unit record systems. A large degree of human intervention is needed to handle the cards, load the machines, and set up new programs. Storage requirements for a very large data base can be expensive. In a nutshell, the cost-performance characteristics of the minicomputer are so much better than either the EAM or unit record systems that, despite savings of pain which will ensue, they will become obsolete.

Mini Design, Maxi Market

Not all minis are suitable for business DP users. In fact, few are, because they weren't designed with the parameters of the business application in mind.

The first consideration is that accounting, from business to business, is about 80% alike, and 20% different. Every business sends out invoices, pays taxes, has a payroll, etc. These functions, differ mainly in the formats, and in the kind and amount of detail involved in processing.

Therefore the minicomputer which will meet the needs of

business, and in particular the price requirements of small business, must employ a sophisticated programming approach which is standardized in the mini, but which can be customized on the periphery.

The software must thus be modular in concept, and must be available in "packages" which can be assembled to suit specific tasks.

Beyond this, such features as time-sharing, multiprogramming, and the designation of jointly accessible files require an addressable structure in the minicomputer that rivals the features of large-scale processors. In particular, relative addressing must be implemented in the hardware to allow dynamic program relocation.

Although any general-purpose computer can be programmed for any sequence of operations that can be completely specified, many conventional minicomputer features and hardware facilities are not especially adapted to the business data processing environment.

Staying Afloat

The minicomputer field has been described as "explosive," and "chaotic." The number of manufacturers of small computers has grown tremendously in the last two years (now estimated to be around 70).

Fortunately, applications areas have begun justifying the investment in minis, to get a toe-hold in the market.

Software Opens New Worlds for Minis

By Allan Whitaker

Special to Computerworld

A computer user's day recognizes that the performance of hardware is not the best measure of how well the computer system will solve his application. Since software is required to instruct the computer, a more important criteria for the success of his computer installation is how efficiently the manufacturer's supplied software coordinates the hardware components.

Today, real-time executive software systems are opening a new world for the small computer simply because the users recognize that the application of any computer system to solve a problem represents a dollar investment from which an optimized return is to be expected. The return on investment is maximized when the computer resources, mainframe and peripheral, are operated to their fullest capacity.

And the real-time executive software systems are:

Helping the user to extend more easily the basic computer system to his particular application—both today and in the future.

Enabling more people within the same organization to gain the benefits from the same small computer installation.

The application of computers to perform a singular function, e.g., communications controller, peripheral processor, is a segment of the marketplace that has been enhanced by the emergence of the minicomputers. The price of minicomputers is such

that failure to utilize its full capabilities represents a small loss of return on investment, and, therefore, is not a major concern of its users.

Foreground, Background

While some minicomputers

G. Allen Whitaker is product manager of analytical data systems at Systems Engineering Laboratories, Inc. He was instrumental in developing Systems Engineering Laboratories' Model 404 Real-time Executive software system.

provide adequate capacity for real-time data acquisition and control (foreground), their system software does not usually provide the resources necessary for data processing activities (background) concurrent with the real-time acquisition and control.

The ability to perform real-time acquisition and control while accomplishing program development on a time-available basis represents a larger sphere of small computer applications. Computer manufacturers have responded with operating systems that allow background operations to occur concurrently with foreground processing.

In a foreground-background operating environment, the foreground processing occurs when an external event occurs to the computer, i.e., an interrupt occurs. Background operations occur when there aren't any interrupts requiring processing.

Foreground program implementation, therefore, requires hardware.

Additional hardware is required if the data analysis must be separated from the real-time acquisition in order that other real-time acquisitions can proceed without interference. Due to the dynamic nature of real-time foreground interrupt, control instructions, e.g., enable, disable, arm, disarm and trigger interrupt, appear in the computer instruction repertoire.

Processing of interrupts by a foreground-background operating system is usually achieved via interrupt control software.

When an interrupt occurs, a process known as "context switching" occurs. In minimal form, "context switching" overhead involves:

Recognition of the interrupt by the operating system.

The CPU operating environment and executive status of the program that was in execution is saved in a program status word.

The program that is to respond to the interrupt is located and placed into execution.

The use of real-time executive software systems with small computer reflects the growing sophistication of the hardware reported trend of users investing more dollars in peripherals and software than in central processing units. Most important, it optimizes computer usage today.

Attention mini computers.

No mini computer has ever enjoyed choosing a printer.

Mainly because there have never been any appropriate printers to choose from.

On the one hand, there were little typewriter-type printers that were much too slow for high-speed mini computers.

And on the other hand, there were big superspeed printers that were designed for big superspeed computers. And they were much too expensive for mini computers.

Those were the choices.

And if the mini computer didn't like it, it was "Sorry, pal, take it or leave it."

Not much fun.

So if you're a mini computer, you'll be glad to know there is now a printer that was designed specifically for you.

It's not too slow. It's not too expensive. It's exactly right.

So rejoice, mini computers.

Rejoice.

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Nortec 200 is 132 columns, prints at 200 lines per minute, produces crisp type on up to 6 copies. The entire unit, with all electronics including buffer controller, easily interfaces with any computer, is as low as \$6000 in large OEM quantities. It's just a little larger than an electric typewriter. The \$6000 price includes these standard features: IBM-compatible vertical format unit, front-opening yoke assembly for easier form loading and ribbon changing, self-test feature for testing electronics and mechanism. Nortec Computer Devices Inc., a C-I-T Company, Southboro, Massachusetts 01772, 617-461-2500.

Mini Systems Increase Quality of Processing Plants

By Gerald E. Mahoney
Special to Computerworld

To meet the ever increasing requirements for better product quality, economical plant operation, and increased production, processing plants are being equipped with a greater amount of instrumentation and a high degree of sophisticated control devices.

Small in comparison to more widely publicized real-time in other fields, the process control small computer systems have been in existence for only a dozen or so years. Yet, they have acquired a degree of sophistication that is not only astounding in view of the apparently small size of CPU used, but impressive in their rapid employment by processing industries.

Process control computer systems sample tens, hundreds, or even thousands of process measurements in seconds—measurements such as flow, temperature, pressure, liquid level, and chemical composition. Discrete inputs, representing the on/off status of hundreds of valves, pumps, or other pieces of equipment are also sensed. Data is monitored to determine that they are within the prescribed limits. If not, special action is taken, either in the form of alarm displays or corrective control action, or both.

Control Functions

Control functions range from relatively simple corrections proportional to the difference between measurement and a reference value (called set point) to complicated, multivariable control laws based on mathematical models of process behavior.

Control functions are often arranged in hierarchies, with the simplest and most frequently executed operations at the lowest level, and increasing in complexity on succeeding levels. The uppermost level can, for example, deal with overall throughput of a plant on an optimum basis with respect to value of products.

Changes in control parameters can be directed downward. Control outputs from the process control computer system can be set-point changes directed to analog controllers, or the functions of the analog controller could be performed by the computer system which would send valve position commands. The latter mode of operation is known as direct digital control (DDC).

In order to provide plant operating personnel with information on process conditions, and to permit intervention by process operators, extensive man-machine communications facilities are supported by the process control computer systems.

In addition to conventional computer peripherals, special display panels and keyboards are provided to allow callup and presentation of data and parameters as well as foolproof entry of set points, laboratory data, equipment status information, and many other parameters.

In addition to control functions and related process operator communications, a primary function of process control computer systems is to provide information to plant supervisory per-



Gerald E. Mahoney is a market product planner with The Foxboro Company. His background includes digital system product planning and systems analysis for a variety of scientific and real-time computer systems.

sonnel and process engineers. Process performance evaluation, production reports, and consumption of materials and utilities are computed and reported.

New control strategies may be tried and evaluation data may be

gathered and logged. Maintenance of process equipment may also be scheduled with the aid of the computer system.

Process Control Software

Standard software support for a process control computer system consists of an extensive library of programs. A real-time operating system is the heart of the software. Such an operating system provides a multiprogramming environment with foreground and background modes of operation. The real-time services furnished by the operating

system include the handling of interrupts generated by contending process input and output equipment, timing, program scheduling on a time or event basis, and core and bulk memory management.

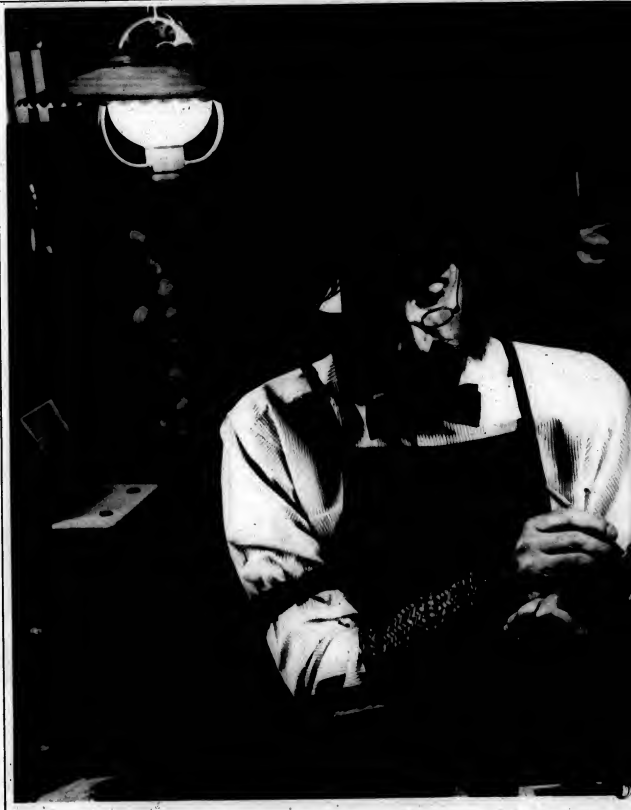
Since process control computer systems are intended to operate 24 hours a day seven days a week, additions or modifications to operating programs must be made on-line, and without interference to the process control functions.

Therefore, program preparation and checkout facilities are

offered as background operations on a time shared basis with real-time programs operating in the foreground.

The program preparation facilities include an assembler, a Fortran compiler (which also handles special statements to permit access to process data by applications programs written in Fortran), source program editors, linking loaders, and subroutine libraries and utilities.

Finally, the standard software includes applications programs to support the data acquisition, control functions, and operator communications tasks.



Microprogramming Offers More Functional Capability

By Charles L. Mathis

Special to Computerworld

Microprogramming is today's buzz word of the computer industry, and like many buzz words, there isn't universal understanding of the term. The management within the large companies is frequently confused over microprogramming and its relationship to the conventional, sequential logic design and the conventional programming techniques.

Microprogramming provides a tool that falls between the two

extremes of implementing complex functions using integrated circuits, which is the most expensive approach, and high-level languages, which are the lowest cost, lowest performance approach.

Definition

The term microprogramming, as used in this article, refers to vertical microprogramming. This technique involves microinstructions which perform one arithmetic or control function for each instruction executed, the type of microprogramming used

by most small processors, such as PDP-8, SuperNova, and Hetra's computer series.

The distinction between As-

Charles L. Mathis is manager of systems development for Hetra. He is responsible for technical guidance and direction of mainframe, systems, and peripheral interface design.

sembly Language programming and vertical microprogramming is difficult to specify (the hardware is more complex for As-

sembler Language instructions). One distinction that is common is that the vertical type microinstructions are generally fixed-length instructions, which are 16 or less bits in length. This fits the IBM 360/25 microinstructions as well as many other machines.

The microinstructions generally have faster execution times than Assembly Language instructions. Frequently, a 10-to-1 performance improvement can be achieved over an Assembly Language program when the function is microprogrammed on the

same machine.

Conventional, sequential logic design is generally implemented using counters to decode control gates. These counters are regularly stepped by the processor to provide sequencing through a series of logical steps. This technique is generally used to implement the hardware in most computer systems.

The significance of microprogramming is that its use in a computer system greatly reduces the system's conventional, sequential logic complexity and cost. (Many microprogrammed processors can do the basic functions provided by the IBM 360/95, at a fraction of the cost.)

Performance is Important

The first factor to weigh when considering whether to implement a logical function using conventional hardware design techniques or microprogramming is performance. If speed of execution is the most important factor and cost is considered secondary, then the use of conventional, sequential logic design techniques to implement the function is appropriate.

Many cases exist where the cost of optional performance of a function cannot be justified because the customer is not willing to pay the cost, or the system has other bottlenecks which justify using an approach that costs less at a lower performance level.

The next item of interest in evaluating the use of microprogramming is changeability. Generally speaking, the modification or addition of function to a machine using conventional hardware design techniques is very clumsy, time-consuming, and expensive.

Microprogramming machines, on the other hand, can have changes or additions of new functions quite easily. The design of the change is a little more tedious than conventional Assembly Language coding.

Another item to be considered in the comparison of sequential hardware logic design to microprogramming is that of complexity. If the function to be implemented is very complex, it is very difficult to implement such a function using conventional, sequential logic design techniques because of timing considerations, logical combinations, and the design coordination involved.

Microprogramming, on the other hand, presents an implementation technique that reduces in magnitude the above problems.

In many cases, the design can be done by a programmer not familiar with the intimate details of the computer's hardware, and in the case of Hetra's microinstructions, he has no timing problems to consider other than the overall system performance.

The last item is machine cost. Initial implementation cost may not be material if thousands of units are to be manufactured. When there are only a few units to be built for special purpose applications, then the microprogrammed machine will generally provide a less expensive product.

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HEWLETT  PACKARD
DIGITAL COMPUTERS

Manufacturer Product Tests Give Minis Optimum Use

By Armando E. Cuesta
Special to Computerworld

From car transmissions to heart pacers and electronic modules is the wide range of products being tested today by minicomputers in manufacturing plants for real-time quality control certification. The testing of hundreds of different products on production lines represents probably the fastest growing area of real-time minicomputer applications.

This extended scope is possible due to the variety of system oriented configurations supported by many computer suppliers.

Hardware is, however, only half of the story. The implementation of such systems requires the availability of a programming system capable of supporting disk or tape based systems. General purpose real time executives have satisfied this requirement providing a solid foundation for the user to build upon his

specific application.

The manufacturing test field has grown at a rate exceeding any other field of process applications.

The speed and reliability of today's computers make possible the sharing of a



Armando E. Cuesta is a system application engineer at Systems Engineering Laboratories, Inc. His application specializes in using computer systems for manufacturing testing.

single computer among a number of production lines. Multiple test stands share a single computer attaining a combined throughput very close to the maximum throughput of the individual test stands.

This is possible because mechanical handlers and instruments have response and

settling times so high compared to the computer that overlapping of test operations provide optimum computer utilization. This operation also provides a common data bank which can be utilized as feedback information to production lines when a failure trend is detected by the test system.

Some of the spare time can be utilized to run batch jobs such as Fortran compilations, assemblies or scientific programs. Present 'real time executives' are designed to support such operations.

An electronics company in the Midwest is utilizing a mini system to test 100% of its electronic modules and cards and to generate diagnostic data. The accumulated test data is stored in disk and retrieved periodically by data analysis programs which detect production trends and generate management and engineering reports on the status of the production line.

The system is also used by engineering personnel to design new electronic modules and to simulate their operation before the modules are built.

Terminal Minicomputers Bring 'Large Computers' into Offices

By Theo L. Fox
Special to Computerworld
Minicomputers with communications

capabilities may very well be the most significant contribution to the continued health and growth of small- and medium-size business.

Although they may vary in size and capability, these minis can bring the power and speed of a large computer into any office or plant at a reasonable cost. The small businessman can then enjoy the same sophisticated data processing systems used by giant corporations through communicating directly with a large central computer system.

From Basic to Computer

Two classes of terminals exist today. Most common is the less expensive and less featured basic terminal, used simply



Theo L. Fox is president of the Victor Communications Corp. Business Machines Group. Prior to joining Victor in 1961, he held key administrative positions for several business machines manufacturers.

as an input/output device to a computer. But the most important, full-of-potential terminal is a minicomputer, used to prepare data before and after transceiving.

The basic terminal is equipped only with transmit and/or receive capabilities, usually a keyboard and a variety of input/output peripheral devices.

Usually, elaborate software is required for the central computer because the terminals require a specific line discipline, a specific baud rate, and rigid message formatting. If it malfunctions, it has a tendency to drop information.

In early telecommunications, the user had no choice but to accept the basic terminal if he required an on-line system.

Today, the terminal computer has altered the entire data communications field. It contains the same options as the basic unit without many of its disadvantages. Although all user problems have not been solved, this mini means the user is no longer required to build his system around a rigid device.

The terminal minicomputer can communicate with larger computers or other terminals and prepare messages, necessary calculations, editing, and formatting.

Through program control, it can also assist the operator in message development, performing such functions as check digit verification, product number assurance, quantity-price calculations, and many other arithmetic or algebraic manipulations.

Plus, it can handle page formatting on a hard-copy device or CRT, as well as message formatting such as zero or blank suppression, field alignment, manipulation, and verification.

The result of this expanded capability of the terminal computer is reduced processing time required at the central computer, less programming of the central computer, and a reduction in line charges.

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FOR
MINIS

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A message to systems designers interested in a higher return on investment in business oriented applications.

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The 501 Datamanager peripheral availability includes:

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Multiplexing of multiple input/output stations such as Selectric, TTY, CRT, etc. are also accommodated.

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Your availability advantage

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Minis to Score Big Improvements With Peripherals

By Don Strong
CW Supplements Editor

Like a veteran, 5-ft, 7-in. reilly pitcher up on waivers, today's minicomputer is small only in size and price.

As the journeyman reliever improves his effectiveness by simply adding a new pitch or two to his repertoire, so can the minicomputer, through the use of peripheral devices, evolve from a process controller to a small but dedicated system able to take over the tasks previously relegated to batch processing on a large system or to time-sharing devices.

The fact that minisystems are feasible now indicates some rather big innings to come for terminals and related items.

According to Roger E. Bremer, president of Data Trends, Inc., "The dollar volume of shipments in this EDP area is growing at a rate of nearly 20% annually."

"Studies of EDP equipment outside of heavy hardware and mainframes indicate

that shipments by U.S. companies in 1972 will amount to \$7.7 billion, out of an industry total of more than \$12.5 billion, exclusive of software and services."

Minisystem is Key

Bremer predicts that because the minicomputer with peripheral equipment designed to maximize its potential continues to open new and broader avenues, in two or three years it will have brought EDP into the day-to-day service of thousands of customers who until now, have merely said "we're thinking about it."

The key to this advance, he feels, is the minisystem, built around a minicomputer using terminals, printers, etc. Bremer also sees the most successful minicomputer application as that which is tailored to meet a specific need.

"The tools are at hand for perfecting and marketing minisystems for thousands of medium and smaller businesses," he

said. "Lower cost components, and disk memories, for instance, can make this a reality overnight. The managerial skills of systems design companies will determine whether the market is realized, and how soon."

Echoes

Thomas J. Reilly, president of Peripheral Data Machines, Inc. feels the same way. He points out that as soon as the minisystems designer develops his concepts, he is launched onto a quest for peripheral devices.

"For auxiliary storage, faster input and output, and data portability in a form compatible with larger data processing systems he turns to magnetic tape," Reilly said. "For random access to large files he seeks drums or disks. For convenient communication in interactive systems he wants keyboard-displays. For rapid output of hard copy he looks for line printers."

These peripherals have been available, Reilly stated, but their price usually matched the computer price. "It doesn't make much sense to put a \$50,000 magnetic tape drive on a \$10,000 computer," he argued.

Applications which appeared feasible when the inexpensive minicomputer came on the scene lost their attraction when high-priced peripherals were required.

The emergence of peripherals, however, signed in capability and price to the minicomputer, has made it possible for "the small business man to have his own data processing installation for his payroll, inventory control, and accounts payable and receivable."

Mismatch of Needs

While the minisystem negates much of the need to utilize service bureau or time-sharing services, Reilly carefully points out "this does not imply that the day of the large, powerful computer system is over."

"There are many tasks," he said, "requiring such systems or, at least, are much more economical on such systems. In these situations, however, we often face a mismatch of mainframe and peripheral speeds."

Reilly said both minisystems applications—the stand-alone, dedicated data processing facility and the large system adjunct—become feasible when low priced minicomputers are married to low priced peripherals.

Concerned with the limited awareness by users of the extent of cost reduction taking place recently, Reilly offered a few examples: "Today, \$11,000 will buy a 600-line/min, 132-column printer, with all electronics, ready to plug into a minicomputer, or it will buy a nine-track, 800-b/in, 25-in/sec magnetic tape drive, with full blown controller, also ready to plug into a mini. A half-million bit, fixed, head-per-track disk, with controller, is available at \$6,200."

"With peripheral prices at these levels and still going down, Reilly concluded, "It is not surprising to witness operating or embryo minicomputer systems for credit-card verification, data concentration, off-line printing, in-house accounting, and computer-aided design."

Roim President Predicts Mini Will Get Tougher

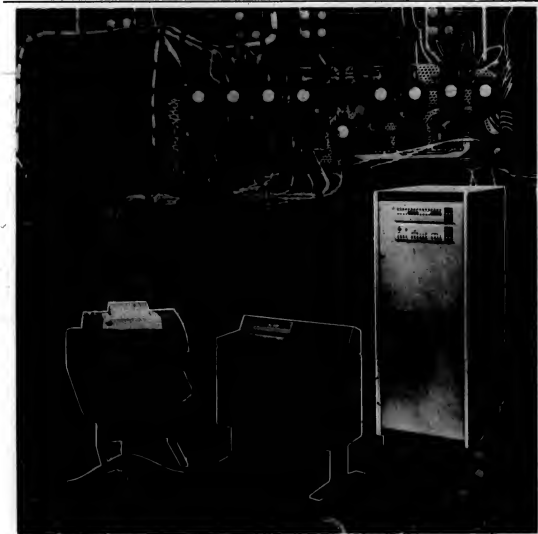
By Don Strong
CW Supplements Editor

The head of a corporation that bills itself as the innovator of the "world's toughest minicomputer" foresees an increasing emphasis on rugged computers that can leave the office and laboratory environment.

Dr. M. Kenneth Osheim, president of the Roim Corp. of Cupertino, Calif., said, "If there is any large trend coming in the '70s, it will be the removal of the machine from the lab and taking it to the source of the problem."

"Machine speeds will have lesser emphasis and the big demand will be for more versatile, modular computers adaptable to a wide variety of applications; rugged computers that can be applied away from offices and labs." (The Roim Model 1601 combines the architecture of a Data General Nova in a package to meet the environmental requirements of airborne shipboard, and ground electronic equipment.)

"Plotting the growth of minicomputers seems to be a favorite pastime in company boardrooms these days. But, one thing is quite clear: Minicomputers are or can be well suited to withstand the rigors of hostile environments."



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Mini's Educationally Oriented Software Helps Schools to Expand EDP Facilities

By Edward R. McCracken
Special to Computerworld

Minicomputers are rapidly changing educational institutions from "computer-poor" to "computer-rich" schools.

Now, due to the advent of educationally oriented minis, most small colleges, junior colleges, and secondary schools, which previously lacked a computer or had a system dedicated to administrative use only, have expanded their computer facilities for instruction. However, further developments are still necessary before minicomputers become commonplace in schools. These include curriculum materials such as computer-assisted instruction programs, text books, and other support materials that will actually integrate computer methods into the curriculum.

Categories

Computer use in education can be classified into five major categories:

- **Computer-Science Education** - The study of computer hardware, languages and operating systems.
- **Computer Problem Solving** - Computer solves problems and develops a procedural understanding of a problem solution.
- **Computer-Assisted Instruction**

(CAI) - Computer interacts with and teaches students concepts.

- **Administrative Data Processing** - Computer meets information-system requirements of the school.



Edward R. McCracken is education market manager at Hewlett-Packard's Cupertino California Division. He was product manager for the HP 2115A computer.

- **Computer-Assisted Laboratory Analysis** - Computer controls and/or analyzes results of laboratory experiments.
- Until recently operating systems and languages were developed, minicomputers were mainly used in the laboratory where the data-reduction advantages outweighed the inconvenience of assembler-language programming and the handling of paper tape for multipass compiling.

The development of the Basic language at Dartmouth and its subsequent implementation on minicomputers was the first breakthrough for student-oriented systems. Other factors have been the development of small

time-sharing systems and operating systems which allow students to program on mark sense cards. These improvements made computer use easier and increased the number of students using a minicomputer during classroom hours.

Today three major types of minicomputer-based systems for instruction exist; small dedicated time-sharing systems; small batch systems using an optical mark reader (with or without disk); and terminals connected to a minicomputer-time-sharing system at another school or a service bureau.

To date, well over 1,000 minicomputer systems have found their way into educational institutions, with at least 300 more schools utilizing terminals connected to mini time-shared systems. Typical examples of computer-student usage are:

- **Gavilan College, Gilroy, Calif.** - A small \$20,000 optical-mark-reader batch system is used to run student programs in Basic language. The system is used in more than 10 courses in mathematics, statistics, and the physical sciences.
- **Phoenix (Arizona) Union School District** - Secondary students in ten schools use terminals linked to a \$100,000 time-shared system running Basic.

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'Dial-A-Drill' Scores Big With Students

By Don Strong
Supplement's Editor

Right now a number of New York kids wouldn't give a broken crayon or a Ron Klinkowski bubblegum card to know what makes the "Dial-A-Drill" computer tick. They're too busy mastering math fundamentals via this unique method of computer-assisted instruction.

Really nothing more than a central minicomputer, perhaps a modified PDP-8/1, Dial-A-Drill can dispatch simultaneous, individualized, drill and practice lessons over the telephone to as many as 16 students (CW, June 3).

To the New York City Board of Education the program represents an efficient way of enhancing the learning process during after-class hours. It assigns problems to each student that will be

neither too easy nor too hard for him, but at the right level to challenge and motivate him.

Yet, ask the youngsters themselves about Dial-A-Drill, what it is, what it does, and their reactions are as colorful and mixed as a fistful of marbles.

To fifth-grade student Serena Gilliam, Dial-A-Drill lessons often come at awkward times, "like when I just got out of the shower or when I'm eating dinner."

A Second Chance

To young Kelly Jefferson, who hopes Dial-A-Drill is "really a

machine," the program is "just great. It gives us a second chance when we get a wrong answer."

Kelly's sister, Caroline, also appreciates the program, but thinks the computer "sounds funny," an opinion shared by other children.

Rosemary Baez, for example, wonders how the computer's voice "got so strange. I suppose, though, it is an artificial voice," she reasons.

Jennifer Chan, on the other hand, is sure the computer sounds like a man, but then (Continued on Page 5/15)



"The computer sounds like a man, but more like a robot when it talks."

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MSI Is Helping in the Design of Modular Assemblies

By Nicholas J. Mazzarese

Special to Computerworld

Perhaps the most important innovation in small computer technology recently is the arrival of true modularity.

True modularity, as discussed here, is the ability to add or remove whole sections of a computer's elements (e.g., memory, peripheral devices, etc.) by simply plugging them in or removing them in a "Tinkertoy" fashion. However, when discussing modularity in detail, it is necessary to make a point concerning new techniques. New component techniques, such as medium scale integration (MSI), are not ends in themselves, but only can be justified as they produce real benefits to the user.

Using the PDP-8/E and PDP-11 respectively as examples, one uses MSI rather exclusively, while the other in a very limited way. In these machines, MSI is only used where it is beneficial. Yet because MSI is one of the current buzz words, it is often thought that the most current "state of the art" applications would absolutely require a manufacturer of small computers to use MSI exclusively.

Helps Design and Assemblies

MSI is here, however, and where applicable, it is helping in the design of modular computer assemblies. Any switch to newer component techniques, such as MSI, LSI, etc., will take place slowly and as economies dictate.

Modularity is perhaps the most important recent technology advance in small computers. This in turn has been made possible

through the development of new types of bus architecture.

Previously, special purpose computers (such as those used in aerospace applications) had a monopoly on the type of bus structure that made true modularity possible, but it is only recently that this same design philosophy has been incorporated into general-purpose commercial computers.

The new bus techniques allow what is essentially the parallel stringing of computer subsystems. By devoting the computer architecture this way, the addition of more computer subsystem units or the substitution of new units for older ones (or damaged ones) can be performed with virtually no modification of the original small computer, and with little down time. This in

turn implies a certain amount of "obsolescence proofing" of any computer that uses this sort of bus.



Nicholas J. Mazzarese is vice president, small computer products, Digital Equipment Corp. He previously did design work on special and general purpose computers for Syllveria.

Memory "Mixing"

Such a structure even permits a certain amount of memory "mixing." Small computers that have this sort of bus structure can have different types of memory — both ROM and read-write — in the same machine.

By utilizing a ROM section in

the overall memory structure, it is possible for a user to replace a portion of his computer's main memory with a fixed, rather than an erasable, segment. This can be very advantageous in both macroprogramming and microprogramming, and in that sense it could form the basis of a protected memory that nonetheless retains read-write advantages.

Significant Advances

There are many interesting theoretical reasons that other forms of memory should replace ferrite memories, but the industry has not yet found another form of computer memory as reliable and inexpensive as the current ferrite core memories.

A significant advance will take place when a large, high-speed

semiconductor memory is developed, but this is not anticipated immediately.

Other potential memory systems, such as the "magnetic bubble" technique, are undergoing research, but at present they are too new, and the research is far removed from practical computer memory applications.

Another significant advance has been in the area of software.

Small computer programming techniques have matured remarkably in what has been, historically, a short time.

Finally, one of the most encouraging trends in the small computer field is that with each technological advance there has been an increasingly favorable price/performance ratio for small computers.

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'Dial-A-Drill' Big With Students

(Continued from Page 5/14)

again, "more like a robot when it talks." Meanwhile Henry Means put it another way: "The computer is a man with a deep voice that talks very slow and sounds like static."

While reactions may differ about its "voice," they agree on certain electronic quirks. According to Julia Rivera of P.S. 171, the computer sometimes "calls up in a teasing mood."

"The only trouble I get with the Dial-A-Drill," she says, "is that when the computer gives me an example, when I give the answer, it says it's wrong. He says, 'What is three times three?' When I do press the button that says nine, it says, 'wrong, the answer is nine.' It has happened two times already. I am happy that I have the Dial-A-Drill."

Weird Noises

Steve Cohen of 35 East 85th St. has been using Dial-A-Drill for two years and is also happy with it. He says, however, "There are some funny times. Several times I press my number (ID number) when the computer says to and it makes weird noises or keeps on saying press my number."

Nine-year-old Elizabeth Rivera offers the best testimonial. "I like the Dial-A-Drill because it helps my sister and I in math. I get excellent in math because I'm in Dial-A-Drill."

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We will continue to cover all the news of interest to users of data processing equipment. Our coverage in this area has already made us the fastest-growing and most widely read user publication — all in just three short years.

The industry is growing. And with it a need for a new media concept.

The computer industry is now the fastest growing in America, and even sharper growth curves are being charted in Europe and Asia. It's rapidly becoming the largest single industry in the nation and should surpass even the automobile industry in the 1980s. In the U.S. alone, more than 250,000 people use 50,000 computers and data processing equipment for almost every conceivable type of job.

And more advances are on the way.

At this time, the computer industry finds itself in a paradox. It is at once the mainstay of the burgeoning information explosion and at the same time starved for information — information of all types on marketing, manufacturing, design and specialized applications.

The information is there, but, to date, no effective medium has been developed to disseminate the data quickly, concisely, and accurately. Key developments in subsystems often go unnoticed, until too late. Market opportunities are missed, because they are not known. And, possibly worst

of all, duplication abounds needlessly, resulting in wasted research and money.

Our "Computer Industry" section will fill that need.

The section will carry all of the news about subsystems used in computer and peripheral gear, in addition to all of the information about complete systems (such as terminals, memories, displays, etc.) offered on the OEM marketplace.

This section will keep systems designers alert to product advances. It will spotlight OEM for executives (new business opportunities) and provide in-depth analyses of present markets. There will also be information on competitive products and where they are being sold, as well as all of the information on the huge government market — federal, state and local.

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COMPUTERWORLD

July 29, 1970

Page 13

Repair Centers to Fix Purchased IBM-Built Equipment

WHITE PLAINS, N.Y. — The establishment of Purchased Equipment Service Centers will enable leasing companies and their customers to have their IBM-manufactured equipment overhauled by IBM.

Previously, owners of IBM data processing equipment were limited to on-site IBM service or to the use of the reconditioning facilities of independent companies.

The service centers, the first of which is slated for opening in

Los Angeles on Aug. 1, 1970, will be equipped to recondition, modify, or repair purchased IBM-manufactured equipment. A center in the New York metropolitan area is scheduled for later this year.

Staffed by IBM's Field Engineering Division, the centers are described by IBM as better assisting customers in effectively using IBM-manufactured data processing equipment by providing them with the option of a physical location, away from

their own sites, where an IBM system or machine may receive service.

One of the functions of the centers will be the reconditioning of purchased IBM equipment. This could include, IBM said, such operations as cleaning, lubrication, repair and/or replacement of parts, and testing of the equipment. The installation of essential engineering changes and the repainting of the system, including minor cover repairs, are also included.

The cost of the service would be a total charge for performing the reconditioning, based, IBM said, on the condition of the machine. In addition, a \$25/day charge would be levied for the use of the service facilities.

Machine modifications will be performed, IBM said, at the same hourly rates as on-site service, plus the \$25/day facilities charge. Modifications, according to IBM, would consist of the installation and removal of system features or model conversion increments. These are restricted to the procedures that are normally field-installable.

In addition, IBM is offering to install, at the owner's request, such other modifications that may be installed on-site.

Other services, such as machine improvement, will be provided at an hourly rate. The \$25/day facilities charge applies here,

too. Parts will be furnished at current prices, IBM said.

A three-month warranty, including parts and labor, will apply to all equipment that has undergone reconditioning at the IBM center. This warranty does not apply, IBM said, to other service center operations.

Use of the service centers is available to not only the owners, but also the lessees of equipment that has been purchased from IBM. Authorization from the owner of the equipment is required, IBM said.

The company also said that the level of service at the centers would be the same as that available to the customer at his own site. The primary advantage of the centers is that the equipment can now be reconditioned and repainted, a service previously unavailable to owners of purchased systems.

BASF Drives Compatible With 2311, 2314

BEDFORD, Mass. — Another source for plug-to-plug compatible disk equipment has opened to the user with the announcement of the 111 disk drive and 1014 disk system by BASF Systems, Inc.

The Model 111 drive is said to be compatible with the IBM 2311 unit, while the 1014 system is, according to BASF, an exact plug-to-plug replacement for IBM's 2314.

Both products are the result of an agreement between BASF and Century Data Systems, a subsidiary of California Computer Products, Inc., Century, the designer of the drives, has licensed BASF to sell 60-cycle drives manufactured by Century in this country, and to manufacture and sell the 50-cycle products throughout Europe and the rest of the world.

The 60-cycle drives will also continue to be available through the CalComp organization here.

Performance Improved

The drives are said by BASF to be plug-to-plug, software, and data compatible with the IBM units. Performance is claimed to be substantially improved

through the use of voice-coil actuators. Full-stroke head positioning time is 60 msec and a track-to-track positioning time is 10 msec, according to the company.

Increased reliability over the hydraulic actuation used by IBM devices is claimed. Data transfer rate is 312K bytes/sec.

The 111 drive has been priced at \$14,000. The 1014 controller carries a price tag of \$48,500 with the 114 drives at \$17,800 each.

Lease prices of the 1014 system are aimed at the large user, the company said. The controller and one drive are priced at \$1,450/mo on a one-year lease, with up to eight additional drives costing \$320/mo, each. Maintenance charges on the controller and first drive will add \$135/mo to the user's bill with each additional drive costing \$60/mo.

The lease price for unlimited equipment usage of the 111 drive is \$585/mo plus \$55/mo for maintenance. Longer term leases for both models at lower cost are also offered by BASF.

Both the 111 drives and 1014

systems are available immediately. The 1014s on a 90-day schedule and the 111s in half that time.

BASF Systems, Inc. is at Cross Bay Drive.

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Sycor Terminal Analysis—Part IV

Six-Unit Configurations Enable User to Save Money

By Malcolm L. Stiefel
Specialist to Computerworld

If the Sycor two-cassette terminal is placed in the hands of a source data generator, such as a sales office secretary or a shipping platform supervisor, and if the source location without the terminal produces enough information to keep a keypuncher in the tab room busy two or three hours every day, then the Sycor terminal begins to save money for the user.

In this situation, the keypuncher is eliminated. In its place, the user purchases a data converter from Sycor for \$5,100 (or \$145/mo.) and several of the \$7,400 basic terminals scattered around the user's facilities. The operating personnel in the source locations key the data onto cassettes, verify their entries visually, and continue their normal activities.

The cassettes are picked up at the end of the day and sent to

Viatron's difficulties in delivery of System 21 and its switch to a purchase-only policy have prompted a search for suitable alternatives. In this series, CW examines the Sycor terminal which comes closest to System 21 in features and also offers users the added capability of interfacing with major manufacturers' computers.

the central facility (say, the tab room) where the converter awaits. One operator pools all the cassettes onto one tape reel. (One 10-1/2-in. reel with 1-in. record gaps and one 80-character record per block, recorded at 800 b/in. will hold the contents of 15 completely loaded cassettes.) The reel is then taken to a service bureau or to the user's own computer for processing.

A configuration consisting of

six terminals, each with two cassettes, and one converter, would cost \$49,500 or \$1,345/mo. The lease price would be less than the cost of two keypunch operators at current salary levels, with typical overhead added.

Such a configuration would serve a user with a tab room who uses outside computing services or one with batch-oriented computer in-house.

If the printer is needed, it should be used in a central location, like the data converter, to generate off-line listings of data on the cassettes. (Note that the converter cannot produce outputs to the terminal, so it can't drive the printer.)

The next major level of automation makes use of the communications option. The source data terminals are outfitted with the appropriate interfaces, and with the unattended feature. Data is captured on the cassette during the day, and sent automatically to a central office at night, where it is recorded on another cassette at a similarly equipped terminal.

To facilitate this operation; the source terminals have an answer-back feature.

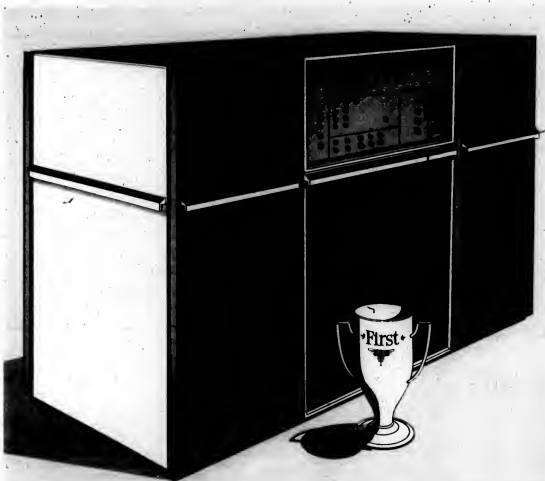
The operator records the data on the computer-compatible tape recorder using an additional terminal in the central office. (Note that the communications terminal can't interface with the data converter, so a separate terminal is needed.) If he happens to be in the user's computer room, he removes the tape and mounts it for processing on the computer.

Prices

The \$5,100 type of data recorder is used, along with a group of terminals that cost anywhere from \$8,100 to \$8,500 each with a communications option and an unattended feature, with two cassettes. (Lease prices range from \$227 to \$242/mo.)

Malcolm L. Stiefel is an independent consultant in the area of systems design. He has had extensive peripheral experience.

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July 29, 1970

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NCR Battles for Local Government Contracts

By Edward J. Bried
CIV Staff Writer

DAYTON, Ohio — National Cash Register Co. (NCR) is preparing for at least two battles with county or local governments who are hesitant in signing contracts.

One action has already been filed, against Erie County in western New York state. The suit seeks to force County Executive B. John Tutuska to sign a half-million dollar contract, although county officials claim the firm is only the fourth-lowest bidder for a computer

sale to the county.

In the city of Canton, Ohio, NCR has threatened legal action if Canton does not consummate a contract, which has not been certified by City Auditor Thomas L. Garrett, who said that there are no funds available. NCR is reported to contend that certification was not necessary because it was a lease, rather than a purchase arrangement.

The company also contends that the Ohio state code exempts public utilities from the necessity of an auditor's certi-

fication. Canton's Century 100 was to be used by the city's water works.

The city council has been ordered by Mayor Stanley A. Cimich "to take whatever action is necessary" to decide the issue, although the city solicitor opined that, without the auditor's certification, a contract does not exist.

Auditor Garrett is said to be interested in another approach to data processing, perhaps a service bureau or data center. Funds allocated for lease of computer equipment last fiscal year have reportedly reverted to the general fund and, as such, are unavailable for this transaction.

At the Erie County seat in Buffalo, NCR lawyers suggested that a "narrow issue" exists: who has discretion in county contracts, the county legislature or the county executive?

Executive Tutuska has ignored the legislature's authorization to acquire NCR equipment, and has proceeded with a series of benchmark tests. The NCR attorney, Paul Foley, said that these benchmarks were "quite obviously an afterthought," since they did not appear in the original specifications.

County Budget Director Louis J. Russo disagreed. He stated that benchmarks were originally suggested by NCR, but that the county could not expect to meet deadlines if it included the tests. Russo stated that "the time constraint has now gone by the boards. So, we decided to have benchmarks after all, and now [NCR] is saying it's unfair."

Russo added that the county invited all other vendors to participate in the tests and "for reasons best known to themselves, NCR decided not to."

RCA, IBM, and Burroughs did participate.

RCA is the second-lowest hardware bidder, and has been recommended for contract approval. NCR was actually the lowest hardware bidder, but Russo explained that "we told all vendors that bids would be evaluated on the basis of 60% throughput, 30% software, and 10% support." On that basis, Russo contends, NCR came in fourth.

Russo also claimed that NCR would have started the benchmarks with an advantage because, being the low hardware bidder, "they could have been

20% worse than everyone else in benchmarks, and they still would have won" the contract.

Russo noted that "for some reason, they chose to try this thing out in the courts, instead of in performance trials." He called the action "rather ludicrous," stating he hoped for quick disposal of the petition.

The Canton equipment was delivered in May, but has not been ordered, The Erie County computer has not been officially ordered, but is "scheduled" for use here in Meyer Memorial Hospital, which is operated by the county.

Maintenance Firms React To IBM Service Centers

Industry leaders had mixed reactions to IBM's announcement of Purchased Equipment Service Centers (see Page 13).

The president of Comma Corp., George O. Harmon, said the new centers would be in direct competition with some activities of his company.

Harmon charged that the establishment of the centers by IBM "is another demonstration that IBM is only responsive to market needs when it can make significant profits or eliminate competition."

"It appears to us that IBM only chose to open these purchased equipment centers," Harmon concluded, "after Comma and other opened centers and demonstrated the capability to handle this market."

The first independent firm to offer computer reconditioning was Computer Hardware Consultants and Services. The president of the company, George C. Metrose, said his reactions to the IBM announcement were similar

to those expressed by Thomas J. Watson Jr., IBM chairman, in 1961.

Watson, at that time said in regard to IBM's responsibilities: "Suppose that you were a competitor — small, precariously financed, without a large support organization and without a big reputation in the field — but with a good product."

"How would you feel if the big IBM company took the action which you propose to take? Would you regard the IBM company as taking unfair advantage of you?"

One industry spokesman speculated that in the long run IBM's centers would result in increased business for the independents.

He said that if the lessees of third-party equipment started demanding that all of the equipment delivered to them be reconditioned first, it might overtax the facilities at IBM's disposal and force the owners to use independent sources.

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Senate One-Bank Holding Company Bill Eases Some Tough House Restrictions

CW Washington Bureau
WASHINGTON, D.C. — The Senate Banking Committee finally reported out its version of the controversial One-Bank Holding Company bill last week, and neither the banking industry nor the data processing industry will be satisfied with it.

The measure, probably one of the most heavily lobbied pieces of legislation to run through the Congressional mill this year, must now go to the full Senate

for debate and passage and then into conference, where differences between it and the House version will be ironed out into final shape for passage into law.

The Senate panel's bill knocked a lot of the tough provisions out of the House version. Two items which will disturb the EDP service industry are the deletion of a section which would restrict bank holding companies from engaging in non-banking activities, including the marketing of computer services, and the elimination of the House version's grandfather clause.

Instead of eliminating the list of businesses specifically prohibited to bank holding com-

panies, the Senate bill would authorize the Federal Reserve Board to establish restrictions on activities not "functionally related" to banking, a rather vague clause.

The Senate version also would make the bill's effective date March 24, 1969, the day the first version of the present bill was introduced by Sen. John Sparkman (D-Ala.). The tougher House measure called for making the effective date May 9, 1956 (the day the original Bank-Holding Company bill was passed), and would have the effect of forcing one-bank holding companies to divest themselves of data processing and other non-banking activities.

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GSA Supply-Schedule Software Products

Chalk Up New Records

WASHINGTON, D.C. — It is only one month into the federal government's fiscal year, and already more companies than ever — seven — have software products listed on the General Services Administration's Federal Supply Schedule.

An official source said that 27 companies had applied for listing in the government-procurement catalog, nearly three times last year's record 10 applications. Last year awards were made to six companies, most of which applied for and received listing for fiscal year 1971.

The current listings are as follows: Pioneer Data Systems, Information Management Inc., Applied Data Research Inc., Computation Planning Inc., Boole and Babbage Inc., Grosvenor Corp., and Industrial Information Inc.

Listings must be requested and granted annually, and a GSA source said that awards are sometimes made as late as December or January. The catalog is updated periodically as new products or services are added.

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California State Department of Parks and Recreation is once again receiving bids on a computerized reservation system for its parks and Hearst Castle. The department is currently in the midst of legal action between the state Attorney General's office and Computer Science Corp. over CSC's cancellation without notice of its Computicket operation.

A spokesman for the department said that even though the cancellation of Computicket earlier this year had been a bad experience for them as they were forced to suddenly revive the manual system at a time when reservations were at their peak, they felt there were sufficient advantages to try computer again.

The main advantage is that camps can go to a nearby terminal location and receive instant confirmation of available sites instead of waiting for a reply by mail.

Forty firms have expressed interest in submitting bids. In addition to reservation companies, bidders include software houses, service bureaus, and computer firms. The reservation system involves a central computer and a network of more than 70 terminals. Installation date is December 15, to be followed by a two week test period with public use being initiated on January 2, 1971.

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Page 21

Bennett Out at Viatron, Hunt Named Chairman

BEDFORD, Mass. — There's one thing nobody denies that Viatron makes, and that's news.

The latest installment of *System 21 Faves Life* shows a majority of the board of directors replacing Dr. Edward M. Bennett as chairman and president and "terminating the employment" of Dr. Joseph Spiegel as executive vice-president.

Prof. Pearson Hunt of the Harvard Business School and a director of Viatron is replacing Bennett as chairman of the board, and Roger R. Phillips, formerly vice-president and general counsel of the company, becomes acting president.

Commenting on the shake-up, Bennett said it was a "stunning experience." He asked jokingly: "What did they see in the job that attracted them?"

Bennett and Spiegel said they had no plans to regain control of the company in the immediate future.

Bennett described the board meeting, which took place in his living room, as "not acrimonious — austere" and "very formal." He said he was taken by surprise and that particular causes for the changes were not discussed at the meeting.

He ascribed his firing to "an evolving divergence of attitude" between those involved with the day-to-day management of the company and the rest of the board.

Both Bennett and Spiegel expressed confidence in Viatron's future and its new management. Spiegel said: "I will do nothing in any way to injure or hurt Viatron."

Bennett also noted that it was his own decision to leave the board and that he has contractual obligations to Viatron to provide technical assistance and support the new management.

No one connected with Viatron would discuss the substantive issues underlying the action.

A member of the faculty of the Harvard Business School since 1940, Hunt has served as a financial planning consultant in the U.S., Spain, Italy, and England. Among his clients were General Telephone and AT&T.

Bennett will become "technical advisor to the president" while resigning as a director; Spiegel remains a director.

In addition, Robert Dockser, former president of Viatron Programming, a subsidiary, was



Pearson Hunt

elected senior vice-president of the firm.

There was speculation among Viatron observers that the change was based on disagreement over the fiscal policies of the company.

The stock market reacted to the news by dropping the price of Viatron common from 7-7/8 to 5-1/2 bid, a new low for the company.

Viatron's recently released second quarter financial statement revealed that the company was still stalled in its attempt to become "the GM of electronics," and still suffered from acute deficits. Viatron stock has been depressed for the last few months.

Honeywell Earnings Up 6%

MINNEAPOLIS — Besides announcing a 10% rise in revenues and a 6% gain in earnings for the second quarter, Honeywell Chairman James H. Binger also revealed that the new company that will take over combined Honeywell and General Electric computer operations has been incorporated and a proxy statement involving the combination will be mailed to shareholders early in August.

The new company is named Honeywell Information Systems Inc.

Binger also said "very satisfactory progress" is being made in the attempt to combine the Honeywell-GE operations.

For the second quarter Honeywell reported revenues of \$381.1 million, up from \$346.4 million a year ago.

Earnings for the quarter amounted to \$15.1 million, an increase of 6% over the same quarter of 1969 when earnings amounted to \$14.2 million. Per share earnings were 96 cents for the quarter on a larger average number of shares outstanding

compared with 95 cents last year.

The results for the second quarter brought Honeywell's six-month sales to \$746 million, compared with \$671.4 million a year ago, and earnings to \$28.9 million, up from \$26 million last year, providing gains of 11% in both categories. For the half, earnings per share increased to \$1.86 from \$1.75 a year ago. Binger said Honeywell's worldwide computer business "continues to grow at the high rate that we have previously noted. June was particularly strong in this area of our business. Order rates are excellent and backlogs are at record highs. We are particularly gratified by the favorable response to new products."

The Honeywell chief executive reported that in the residential and larger building market the company's business was mixed. "The low level of housing starts in the U.S. continues to be a factor," he said, "although there are some signs that an upturn may be in sight. Billings and margins so far are holding up well."

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NCR 2d Quarter Earnings Show Decline

NEW YORK—Worldwide revenues of the National Cash Register Co. through June 30 totaled \$649,122,000, an increase of 13% over the \$573,756,000 recorded for the comparable period of 1969.

Six-month earnings were \$18,581,000, compared with \$17,361,000 for the first half of last year, or an increase of 7%. On a fully diluted basis, they amounted to 86 cents per share compared with 81 cents per share.

For the second quarter, revenue totaled \$344,045,000, an increase of 11% over the \$308,995,000 recorded for the second quarter of 1969. Earnings for the period were \$10,432,000, compared with \$10,845,000 reported for the second quarter of last year. The second-quarter earnings on a fully diluted basis were 48 cents per share compared with 50 cents per share last year.

Robert S. Oelmann, NCR chairman, said the second-quarter results were unfavorably affected by a lower than anticipated

volume of equipment deliveries in the U.S.

"The continuation of the weakness in the U.S. economy during the second quarter caused a number of customers to defer equipment installations that had been scheduled for that period and also adversely affected domestic incoming orders," he said.

To a considerable extent these negative

factors were offset by the company's operations abroad, where most countries' economies are strong and incoming orders continue to set new records," the NCR chairman said.

Oelmann said that some capital investment programs have been deferred and a number of cost-reduction programs have been undertaken in view of the current slowdown in the U.S. economy.

Comsat Revenues, Income Rise

WASHINGTON, D.C.—The Communications Satellite Corp. (Comsat) has reported that net income increased to \$3,974,000 or 40 cents per share for the second quarter of 1970, compared to \$1,976,000 or 20 cents per share for the second quarter of 1969.

For the first six months of 1970, earnings totaled \$7,319,000 or 73 cents per share, compared to \$3,501,000 or 35

cents per share for the first six months of 1969.

Satellites

The increase in net operating income from \$578,000 a year ago to \$2,424,000 for the second quarter of 1970 resulted from the continued gain of revenues occasioned by more complete utilization of satellite facilities placed in service during the year 1969 and early 1970.

Revenues totaled \$16,793,000 for the second quarter and \$32,228,000 for the first half of 1970. Last year revenues totaled \$11,546,000 for the second quarter and \$21,768,000 for the first half.

The company attributed the increase in revenues to the growth in the number of leased equivalent full-time half circuits from 1,334 a year ago to 1,657 at June 30, 1970, with most of the growth occurring in the higher priced circuits.

Gerber Net Up 21.3%

SOUTH WINDSOR, Conn.—Record sales and earnings for fiscal year ended April 30, 1970, were reported by The Gerber Scientific Instrument Co.

It was the sixth consecutive year that Gerber, a builder of automatic digital drafting systems, reported record levels.

Consolidated sales for Gerber and its subsidiaries amounted to \$11,423,701, an increase of 24.4% over a similar period ended April 30, 1969. Consolidated earnings were \$921,824, an increase of 21.3% over the prior year. Per share earnings were 92 cents in 1970 compared to 76 cents in 1969.

Acquisitions

Infodata Systems Inc., has agreed in principle to acquire Benefit Group Administrators, Inc. of Washington, D.C. Infodata Systems, a computer information services company, is headquartered in Webster, N.Y., and operates a regional office in Arlington, Va., and a data center in Bethesda, Md. Benefit Group Administrators offers a range of financial services principally related to group insurance. It also operates a data processing subsidiary, Compco, Inc., which will be combined with Infodata's data center in Bethesda.

Datel Systems Corp., Canton, Mass., has been fully acquired by Varadyne Industries Inc., of Santa Monica, Calif., a diversified manufacturer of hybrid, monolithic, and MOS microcircuits as well as associated packaging materials. Datel Systems will be known as Varadyne Systems, and will continue under the existing management and at the same location with expanded facilities and personnel.

Affiliated Computer Systems, Inc. and Computer Congenics Corp. have entered into a definitive agreement whereby Congenics will acquire for common stock of Congenics all of the assets and liabilities of Affiliated. The agreement is subject to the approval of the stockholders of Affiliated. Computer Congenics, based in Oklahoma City, operates bank and geophysical field processing, microfilming, and educational seminars and training.

Rome Research, Inc., a New York City data processing firm specializing in services to the publishing industry, has acquired control of Software Systems, Inc., a Washington, D.C.-based computer services company. The acquisition includes Reid & Thomas, Inc., a wholly-owned subsidiary of Software Systems. Simultaneous with its acquisition of the stock of Software, Rome Research entered into an agreement with Software wherein for cash and licensing privileges for certain of the proprietary computer systems owned by Rome Research, Rome will acquire additional stock to raise its ownership above 80%.

Computer Dimensions, Inc. (CDI) has entered into an agreement in principle to acquire California Bankdata Corp., a firm specializing in providing full data processing banking services to independent banks. The proposed acquisition is for an undisclosed amount of CDI stock. California Bankdata Corp., headquartered in Los Angeles, would continue under the direction of its current president.

Saxon Industries, Inc. has acquired in principle Multidata Corp., Westminster, Calif. It is contemplated that under the terms of the proposed transaction Saxon will issue shares of its common stock and Multidata will be a wholly owned subsidiary of Saxon.

Booth Computer Shows Earnings, Revenue Increase for Mid-Year and for 2d Quarter

SAN FRANCISCO—Booth Computer Corp. reported six-month revenues of \$20,497,000 for the period ending June 30, 1970, and earnings of \$1,503,000, or 80 cents a share.

This compares with revenues of \$18,586,000 for the similar period last year and earnings of \$1,407,000, or 77 cents a share.

Fully diluted, the per share earnings amounted to 73 cents for the first six months of 1970, and 68 cents for 1969.

Revenues for the quarter ending June 30, 1970, were \$10,275,000 as against

\$9,532,000 for 1969, with net income of \$776,000, or 41 cents a share, compared with \$703,000, or 39 cents a share for 1969.

Fully diluted earnings for the quarter were 37 cents in 1970, and 34 cents in 1969.

Chairman D.P. Booth Jr. said: "We are in an excellent financial condition with a strong cash position and credit lines in excess of our needs. We have actually prepaid approximately \$6 million of our senior debt during the first six months of this year, and we plan to continue this practice of prepaying our debt."

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CLOSING PRICES THURSDAY, JULY 25, 1970

E					
C H					
1970 CLOSE WEEK WEEK					
RANGE NET 1970 CHNGE CHNGE					
(1)					
SOFTWARE & EDP SERVICES					
O	ADVANCED COMP TECH	2-6	1 3/4	0	0.0
A	APPLIED DATA RES.	1-3	1 1/4	-1/8	-3.5
D	APPLIED LOGIC	3-19	2 5/8	-1/8	-3.5
O	ARIES	1-5	5/8	1/8	+1.1
A	AUTOMATIC DATA PRDC	23-47	47 5/8	+1/8	+0.3
O	AUTO SCIENCES	15-14	7 3/4	+3 1/4	+29.1
O	BRANCO APPLIED SYS	1-9	2 1/2	-1/8	-3.5
O	COMPUTER AGE INDUS.	1-5	1 1/4	0	0.0
A	COMPUTER APPL	2-12	5	1/4	+5.0
O	COMPUTER ENVIRON	5-6	1 1/2	-1/8	-3.5

N COMPUTER INDUS.	2-10	5	0	0.0
N COMPUTER MEINING	1-14	7 1/2	+1/2	+7.1
N COMPUTER PROPERTY	9-15	6 1/2	-1/8	-1.1
N COMPUTER SCIENCES	7-14	5 1/4	0	0.0
N COMPUTER USAGE	2-8	2	-1/2	-12.8

A COMPUTING & SOFTWARE	16-75	25 1/2	-1 1/2	-19.0
O CORROSS	2-18	2 5/8	-1/8	-3.5
O COUNCHANE	1-15	1	0	0.0
O CREDIT, ANAL. CENT.	1-10	2 1/4	-1/8	-11.1
O DATA AUTOMATION	1-10	1 1/4	0	0.0

O DATA PACKAGING	5-29	1 1/2	-1/8	-5.7
O DATAMATION SERVICE	1-9	1 3/4	+1/4	+16.6
O DATATAC	1-28	1 1/2	0	0.0
O DIGITEC	2-3	5 1/4	-5/8	-17.8
O EDP RESOURCES	5-13	5 1/2	0	0.0

A ELECT COMP PROG	1-11	1 1/2	-2 5/8	-160.4
O ELECTRONIC DATA SYS.	21-161	51	0	0.0
O INFORMATICS	4-21	7 1/8	-1 1/8	-14.7
A ITEX	1-2	8	0	0.0
O LEVIN-TOWNSEND SERV.	1-13	1 1/2	-1/2	-25.0

A MANAGEMENT DATA	9-25	3	-7/8	-8.8
O NAT. COMP. ANALYSTS	2-8	4	5/8	+25.0
NAT. COMP. SERV.	3-12	6 3/4	0	0.0
N PLANNING RESEARCH	15-25	16 1/4	+3/4	+2.8
O PROGRAMMING METHODS	2-17	8	0	0.0

O PROGRAMMING & SYS	2-5	2 5/8	+1/8	+5.0
O PROGRAMMING SCIENCES	2-25	2 3/4	+1/4	+7.7
H SCIENTIFIC RESOURCES	2-22	2 1/4	-1/8	-4.3
O SOFTWARE SYSTEMS	1-2	5 1/8	0	0.0
U TBS COMPUTER CENTERS	6-27	7	-1/2	-7.6

U UNITED DATA CENTER	3-4	2	+1/2	+55.3
H UNIVERSITY COMPUTING	19-89	22	0	0.0
A U.S. SYSTEMS	2-11	5 1/8	-3/8	-6.2
U U.S. TIME SHARING	5-14	5 1/2	-1/8	-5.4

PERIPHERALS & SUBSYSTEMS

A ECHOSOUNAPHIL-HULT	21-67	62 1/4	0	0.0
O ALPHANUMERIC	1-2	1 1/4	0	0.0
H AMPS CORP.	15-48	16	+1/8	+0.7
A ASTORIA	1-2	1 1/4	0	0.0
U BOLT-HERRMAN & NEW	3-11	8 1/4	0	0.0

B BUNKER-HUGO	6-14	7	-1/8	-1.7
A CALCOMP	13-35	35	+1/4	+1.6
O CUMMINTONICS	4-15	5 1/4	0	0.0
O COLORADO INSTRUMENTS	4-15	4 7/8	-1/8	-2.5
O COMPUTER COMMUN.	8-36	6 1/2	-1/2	-14.7

A COMPUTER EQUIPMENT	1-4	4 1/8	+5/8	+15.4
A COMPUTES	15-26	17 5/8	+1/4	+1.4
A DATA PRODUCTS CORP	7-26	7 5/8	-1/2	-8.5
O DATA TECHNOLOGY	5-15	6 1/2	-1/4	-5.7
O DIGITRONICS	5-15	5 1/2	-1/4	-4.3

H ELECTRONIC H & M	7-40	7 7/8	-5/8	-4.5
O FARRI-TEC	5-8	8 1/4	+1/4	+4.3
U FARMINGTON APT	2-7	7 1/8	+3/4	+15.7
O INFORMATION DISPLAYS	6-20	5 1/2	0	0.0
A MARSHALL INDUSTRIES	11-67	17 1/4	+1 1/2	+9.7

A HILGO ELECTRONICS	15-49	20	+1/2	+5.2
H HONAHY DATA SCI	19-87	22 1/4	+3/4	+5.4
O OPTICAL SCANNING	15-27	22	+1/2	+5.0
O PHOTON	4-17	5	+1/4	+2.5
U PHOTO-MAGNETIC SYS.	1-4	5 1/4	-1/8	-6.8

A POTTER INSTRUMENT	1-12	15 5/8	-1 1/8	-10.8
O PRECISION INST.	7-25	15 1/2	0	0.0
O RECOGNITION EQUIP	15-45	18	+1/2	+2.8
O RECTOR CORP	9-34	34	0	0.0
N SANDERS ELECTRONICS	7-29	10	-2 5/8	-55.3

O SCAN DATA	7-55	7 1/2	0	0.0
O TALLY CORP.	10-20	12	-1/2	-4.0
O TILES	11-25	13 1/4	0	0.0
U VIATRUM	8-51	8	-3/8	-5.8

SUPPLIES & ACCESSORIES

H AUMAS-HILLIS CORP	8-15	11 1/4	+1 5/8	+14.4
U BALTIMORE BUS FORMS	14-21	11	-1/2	-4.5
A BARRY-PIRUM	8-23	23 1/2	0	0.0
A DATA DOCUMENTS	13-19	14	+1/2	+3.8
H ENNIS BUS FORMS	11-19	14	+2 1/4	+17.9

O GRAPHIC CONTROLS	8-17	9 1/4	+1/2	+5.8
H MEMORE	15-18	18 5/8	+1 1/2	+7.2
U JIM COMPANY	17-114	81 5/8	+3 1/2	+4.6
O MOORE BUS FORMS	12-27	28	0	0.0
H NASHUA CORP	21-45	25	+1/2	+2.0

U REYNOLDS & REYNOLD	25-48	28 1/2	+1	+3.6
U STANBRO REGISTER	20-50	50	0	0.0
U LAMCO	22-50	25	+1 3/4	+7.5
A HARBAS MAGNETICS	8-50	8 3/4	-1/8	-9.5
U WALLACE BUS FORMS	35-44	32 1/2	-2 1/4	-7.4

X C H		1970	CLOSE	WEEK	WEEK
		RANGE	JULY 25	NET	PCT
		(1)	1970	CHANGE	CHANGE
	COMPUTER SYSTEMS				
H	BURROUGHS CORP	78-175	95 1/4	+1 1/2	+0.5
H	COLLINS RADIO	8-57	12 5/8	+1 3/4	+16.0
N	CONTROL DATA CORP	50-132	50 7/8	+5/8	+2.0
A	DIGITAL EQUIPMENT	50-124	54	0	0.0
H	ELECTRONIC ASSOC.	3-11	4 1/2	-1/8	-2.7
A	ELECTRONIC ENGINEER,	5-14	4 5/8	+3/4	+15.6
H	FORSDORF	18-59	19 5/8	+7/8	+4.6
U	GENERAL AUTOMATION	8-42	12 3/4	+1 1/4	+10.8
N	GENERAL ELECTRIC	50-77	78	+1	+1.3
H	HENKETT-PACKARD CO	20-45	22 1/2	+5/8	+4.4

H HONEYWELL INC	85-152	75	+4 5/8	+8.5
H IBM	237-587	257	+5	+1.1
H ICR	54-86	55 5/8	-1/8	-0.5
H JANITEX	18-34	20 7/8	+1 1/2	+15.6
H RAYTHEON CO	18-55	19 1/4	+1 1/4	+1.3

O SCI. CONTROL CORP.	1-8	1 1/8	0	0.0
H SENTRY RANO	24-40	26 1/2	+5/8	+2.4
O SYSTEMS ENG. LABS	10-40	15 1/8	-1/4	-1.4
N VARIAN ASSOCIATES	18-51	20 1/8	-2	-9.0
A WANG LABS.	18-51	20 1/8	-2	-9.0

H XEROX CORP	70-115	75 5/8	-2 1/8	-2.8
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LEASING COMPANIES

U GORTHE COMPUTER	9-25	9	-1	-10.0
O BRESNAHAN CORP.	4-5	5 7/8	+1/4	+6.0
U COMPUTER EXCHANGE	2-8	5	0	0.0
U COMPUTER LEASING	2-18	5	0	0.0
H DATA PROC. F & G	6-32	8 5/4	0	0.0

O OATRONIC RENTAL	2-8	5	+1/4	+9.0
A OLABORIO COMPUTER	10-24	15 5/8	+1 1/4	+11.1
U DIEBOLD COMP. LEAS.	2-8	5 1/4	0	0.0
A OPA, INC.	5-10	5 7/8	-1/8	-5.1
A GRANITE MGT	2-12	11	+1/4	+2.2

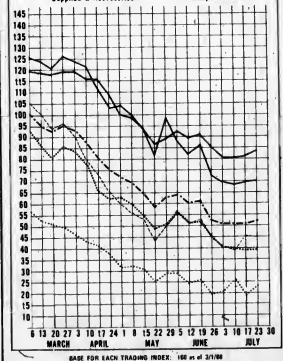
A GREINOWH COMPUTER	5-44	6	+3/8	+2.1
H LASCAS DATA PROC.	7-50	9	+5/8	+7.4
U LECTRO COMP LEAS.	2-3	3 1/4	-1/4	-4.3
A LEVIN-TOWNSEND CORP	5-19	4	-3/8	-8.5
U LMC DATA, INC.	1-3	1 5/8	+1/8	+10.0

U MANAGEMENT ASSIST	1-4	4 1/2	0	0.0
H MCC LEASING	3-8	7 1/8	+1/4	+4.0
O SYSTEMS CAPITAL	2-8	5	+1/4	+9.0
A U.S. LEASING	3-19	12 3/4	+1 1/8	+6.6

EXCH-NYSEY EXCHANGES-AMERICAN EXCHANGE
L-NATIONAL EXCHANGE O-DUVER-26-26-26
U-T-C PRICES AND BID PRICES AS OF 5 P.M. OR LAST BID
(1) TO NEAREST DOLLAR

Computer Stocks Trading Index

— Computer Systems — Software & EDP Services
— Peripherals & Subsystems — Leasing Companies
— Supplies & Accessories — CW Composite Index



BASE FOR EACH TRADING INDEX: 100 as of 3/1/70

Earnings Reports

GENERAL ELECTRIC CO.

Quarter Ended June 30

1970 1969

Rev \$1,000 \$1,000

Earnings \$2,338,233,000 \$2,282,027,000

8 Mo Str \$9,258,000 \$9,173,000

End \$2 \$1.87

Rev \$3,922,481,000 \$3,038,033,000

Earnings \$5,675,000 \$6,189,000

e-Subject to audit at end of year.

DATA-CONTROL SYSTEMS INC.

New Month Ended June 25

1970 1969

Rev \$3,807,000 \$3,036,655

Income (Loss) (\$904,000) \$75,118

BARRY WRIGHT CORP.

Quarter Ended June 30

1970 1969

Rev \$1,190 \$1,190

Earnings \$1,190 \$1,190

8 Mo Str \$1,190 \$1,190

Rev \$1,190 \$1,190

Earnings \$1,190 \$1,190

8 Mo Str \$1,190 \$1,190

Rev \$1,190 \$1,190

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